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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXVI NO. 6 SAN FRANCISCO, FEBRUARY 11, 1911 PER COPY, 25 CENTS

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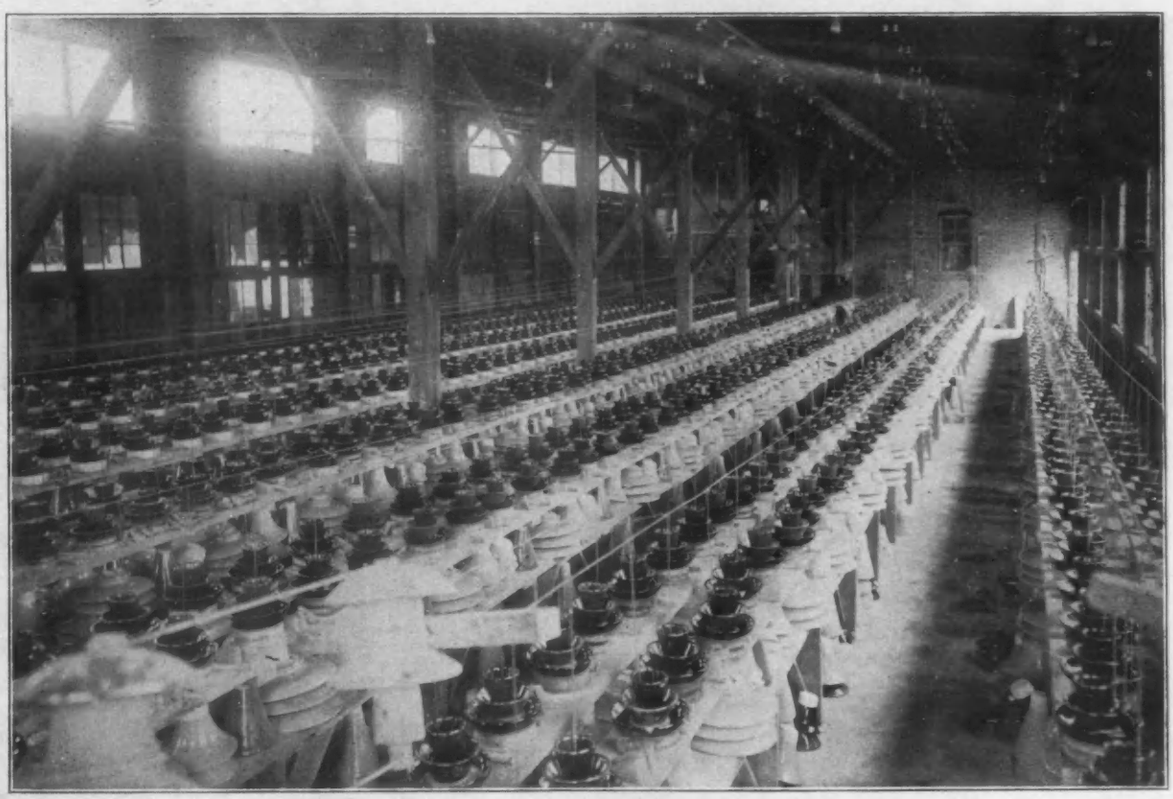

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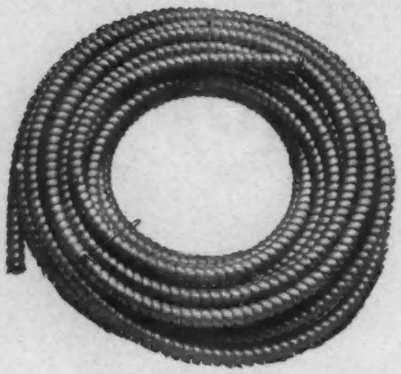

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Place	Population.
Agua Caliente	50
*Alameda	27,000
**Albany	800
††Alta	200
Alvarado	200
Amador	200
Antioch	3,000
††Auburn	2,050
Barber	200
**Belmont	600
Belvedera	350
Benicia	2,500
**Berkeley	42,000
Big Oak Flat	150
Biggs	750
Black Diamond	500
Brentwood	200
Brighton	100
Broderick	500
‡Brown's Valley	50
**Burlingame	5,000
Byron	200
Campbell	1,000
Cement	1,500
‡Centerville	20
Centerville	500
**Chico	13,000
**Colusa	2,700
†Colfax	400
Colma	500
Concord	1,500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Davenport	1,000
Davis	750
Decoto	350
Dixon	1,000
Dobbins	50
Drytown	100
Durham	500
†Dutch Flat	400
**Easton	500
**East San Jose	1,500
Eckley	20
Emerald	50
Elmhurst	2,500
Elmira	150
El Verano	100
**Emeryville	2,000
Encinal	20
Fairfield	800
**Fair Oaks	250
Fitchburg	250
Folsom	1,500
*Fresno	35,000
Glenn Ellen	500
Gold Run	100
Grafton	350
†Grass Valley	7,000
Gridley	1,800
Groveland	50
Hammonton	500
Hayward	4,000
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Ione	900
Irvington	1,000
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Lawrence	100
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Los Altos	200
Los Gatos	3,000
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Perkins	200
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Peyton	250
**Piedmont	2,000
Pinole	1,500
Pleasanton	2,000
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Richmond	10,000
Rio Vista	200
‡Rocklin	1,050
Rodeo	100
†Roseville	345
Ross	900
***Sacramento	52,000
San Andreas	200
San Anselmo	2,500
San Bruno	1,500
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Tormey	150
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½ the size of all the New England states combined

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FIREPROOF SUBSTATIONS

BY C. F. ADAMS[1]

C. F. Adams

The problem of how to deliver light, heat, and power without "spilling" the goods en route, has always engaged the minds of transmission men.

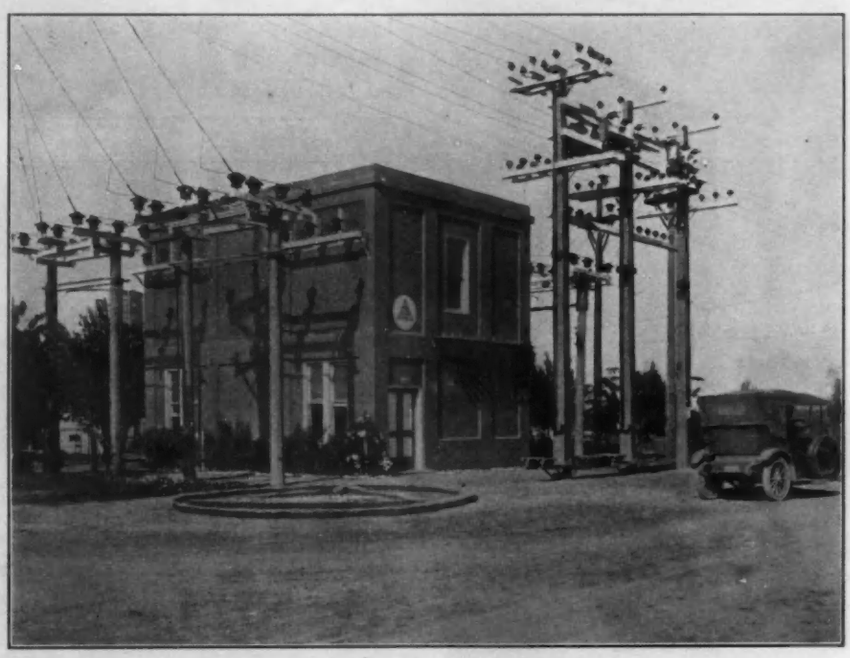
Owing to the concentration of apparatus at substations, there are always a large number of possible "spilling" points centered there. Many of the earlier switching stations and small sub-stations came to grief before the importance of fire prevention was realized. A free high tension arc in a small substation is not a proper subject for close attention, in the station.

From a study of human impulse, the emergency switches are always located out of doors, and these are generally supplemented by high tension fuses, at stations where an attendant is not on continuous duty. For the past four years, one station after another has been rebuilt and constructed of fire proof material. Reinforced concrete is the material most employed in the more important points. Concrete barriers separate the high tension oil switches, and in some stations they are used as bus partitions also. For the moderate country station, the preferred structure is of galvanized steel mounted on a steel frame, the floor being of concrete.

The concrete station is found to be invulnerable as regards high tension arcs and flame. Galvanized steel stations provide an excellent ground path for a free arc, which generally centers on a limited surface.

A few holes the size of bird shot through the sheet steel is generally the limit of the damage in a steel building when high tension trouble occurs.

Our technical literature and the discussions of the Institute of Electrical Engineers devote many pages to the subject of fire risk from the use of oil type transformers. Many of the foremost engineers insisted that the station fire risk was directly proportional to the amount of oil involved. General experience always determines disputes of this nature, and the practice of the Pacific Coast engineers, in avoiding expensive transformer compartments, oil drains, and special transformer fire apparatus has been vindicated by time. Oil cannot burn unless it is very hot, or fed through some form of wick. You cannot overheat several hundred gallons of oil in a few minutes time.

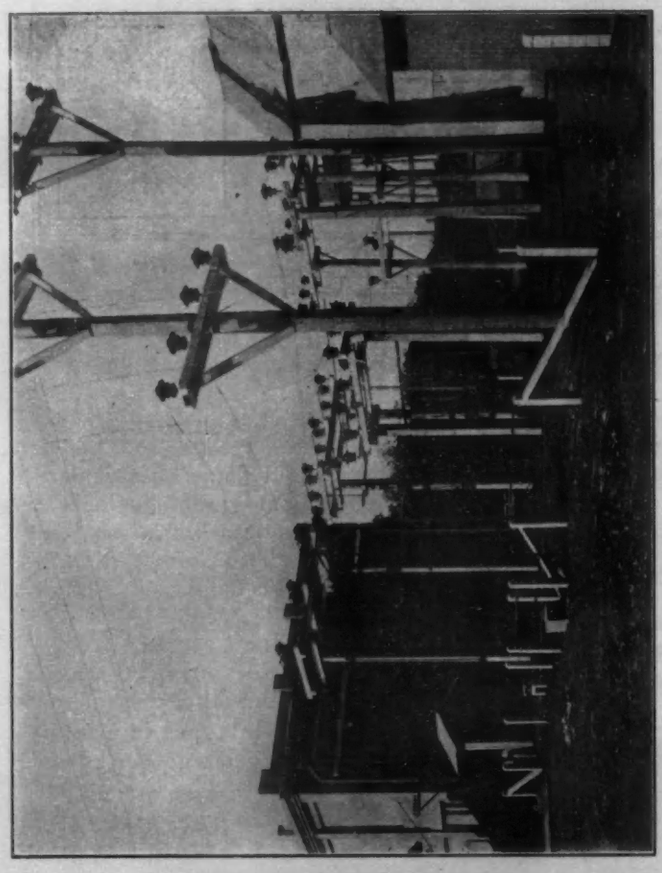


Mountain View Substation.

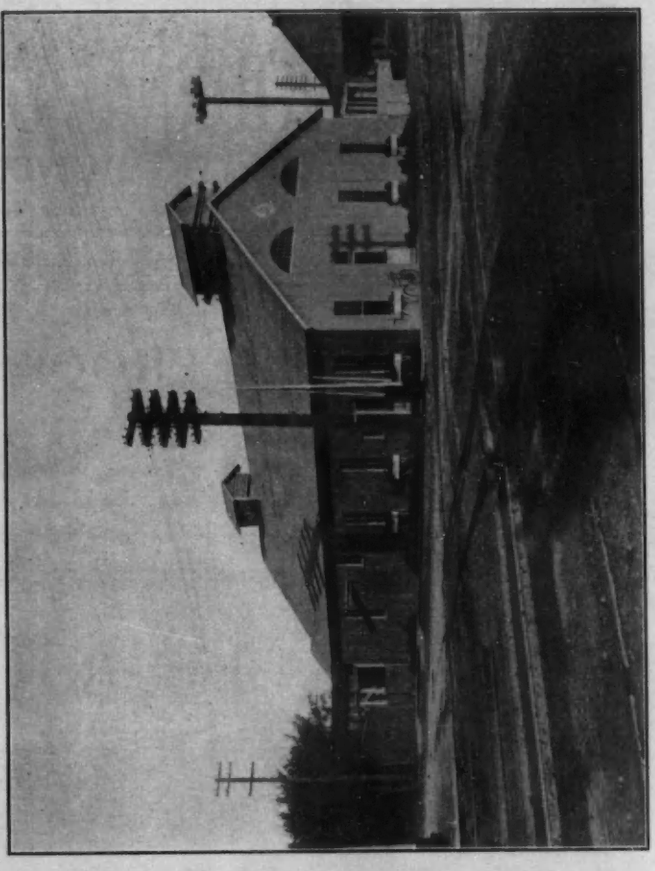
A proper fuse or automatic switch will protect a transformer against much damage from internal short circuit. The absence of external combustible material is the best protection against possible external heat. If there is nothing combustible in the structure of a station, transformers require no fire housings.

This general principle has governed the design of

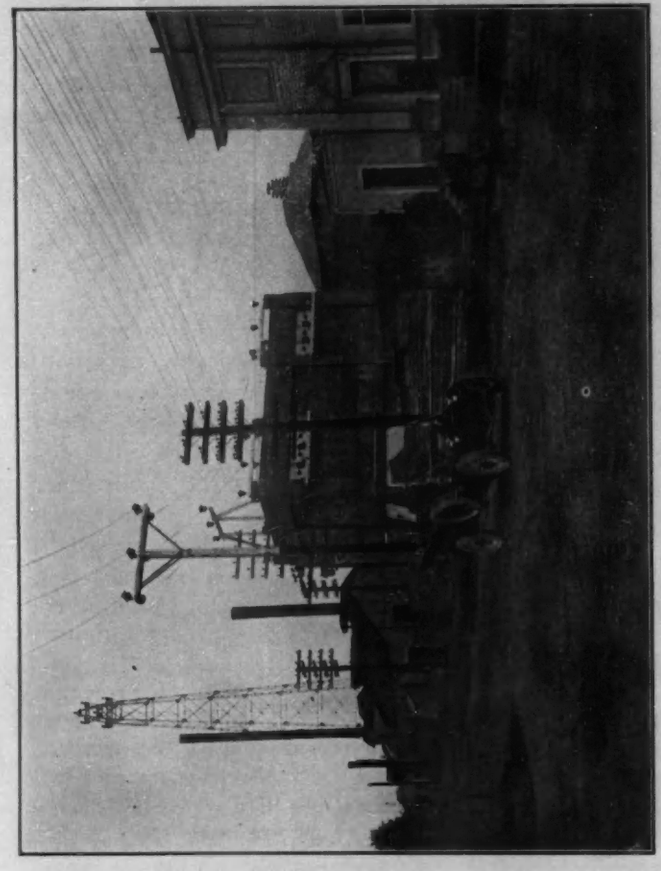
[1] Engineer of Electric Construction, Pacific Gas & Electric Company.



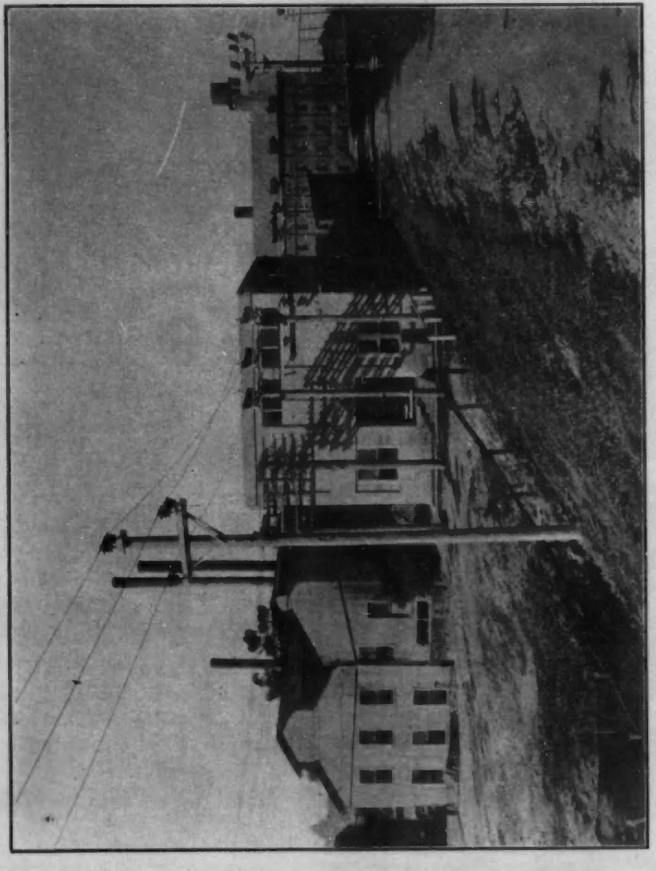
Chico Substation, Rear View.



San Mateo Substation, on the Railroad Near the Passenger Station.



Redwood Substation and Power-line Tower.



Marysville Gas Works, Substation, and the Sperry Flour Mills.

stations and their internal arrangement. The accompanying photos show the external line and switching structures, as well as the character of buildings now in use by the Pacific Gas & Electric Company.

Redwood, Marysville, Chico and Mountain View have excellent examples of the compact concrete buildings. Hammontown has a galvanized steel structure, while the stations at San Mateo and Palo Alto, are housed in masonry structures, whose combustible material is limited to the roof only.

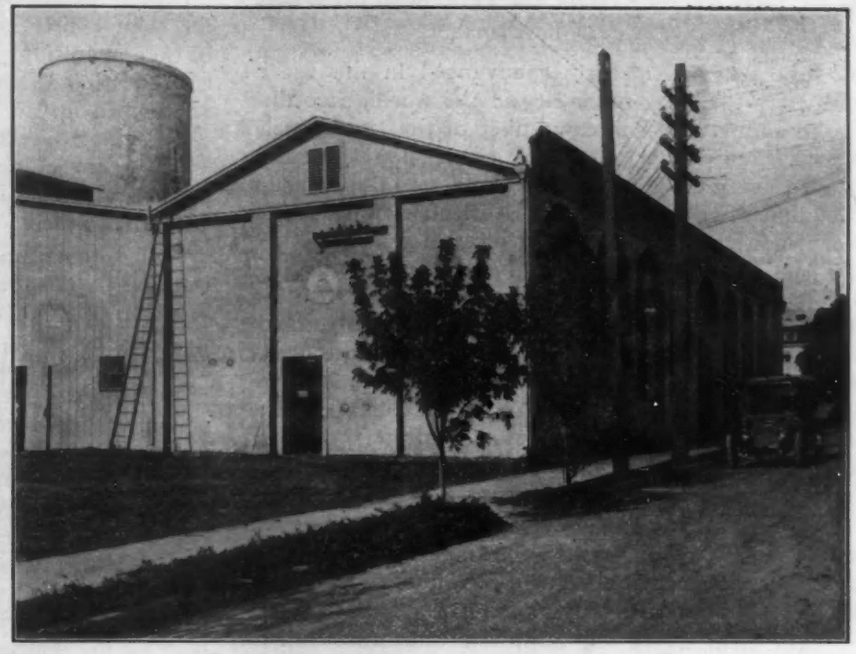
Of the above concrete stations, Marysville contains five sets of three-pole 60-kilovolt oil switches, being an important switching station. Its transformer equipment consists of six 500-kilowatt units, which supply current for six two-phase circuits for light and power purposes.

Chico station has 1700-kilowatt capacity of transformers, and is also the junction point for the lines of the Northern California Power Company.

Mountain View station contains 1500-kilowatt capacity of transformers supplying current to Palo Alto and Sunnyvale. It is also an important switching station. The industry and taste displayed on the lawn and yard decorations have made this a "premium station," and the station interior is as well kept as the grounds.

Redwood City station contains six sets of 60-kilovolt oil switches, and a transformer equipment of 1500-kilowatt. Four distributing circuits are operated from this point.

The operating success which has followed the adoption of the fire-proof station is its best recommendation, and all future stations are being planned for the same permanence and high grade service.



Palo Alto Substation, Near the Railroad.

Hammonton Substation, Supplying Twenty Gold Dredgers on the Yuba River.

PUBLIC UTILITIES COMMISSION PROPOSED IN UTAH.

The creation of a public utilities commission, with jurisdiction over all public service corporations in Utah, is authorized by a bill introduced by Senator Badger, of Salt Lake. The bill gives the commission executive powers over the corporations specified with reference to fixing standards of rates to be charged, adjusting differences and regulating the business of the corporations. The commission is to consist of three members, appointed by the Governor. Not more than two of the members shall be affiliated with the same political party. One commissioner is to be appointed for two years, another for four years and the third for six years. At the expiration of each term the successor of the original appointee is to be named for six years. One commissioner is to devote all of his time to the work and the other two part of their time.

Oil burning boats to the number of 340 are credited to the port of San Francisco, according to the records of the U. S. Steamboat Inspectors' office, as compiled by John K. Bulger. The total tonnage of these vessels is 391,521 and their consumption of fuel oil is estimated at 25,000,000 barrels per annum.

ELECTRICAL STRIDES IN THE SOUTHWEST.

BY CHAS. H. PEIRSON.

Los Angeles is further advanced in the use of electricity than any other city in the world, according to the annual mid-winter number of the Los Angeles Times. Its people use more electricity per capita. Almost every dwelling, from the shack to the mansion, is equipped with electric lights. Electricity is used for more industrial purposes than elsewhere. Events of the past month indicate that the year 1911 will see it become the exclusive motive power for all transportation save transcontinental and long coastwise hauls. In agriculture electricity has taken a more prominent place than in any other industry, and for irrigation and bringing to the use of humanity great areas of productive land, it has proven so efficient that the expert minds devoted to its study do not hesitate to make startling predictions for the future.

The great era of the development of electric power by the private corporations operating in Southern California commenced in 1906, and continuing to the present time is chronologically as follows:

The bringing in of Southern California Edison Company's Kern River power plant with a capacity of 30,000 horsepower.

The completion of Southern California Edison Company's steam plant in Los Angeles, with a capacity of 16,000 horsepower.

Following this was the development by the Pacific Light & Power Company of its Kern River plant with a water-power capacity of 10,000 horsepower.

Next the Pacific Light & Power Company completed its steam plant at Redondo, with a capacity of 20,000 horsepower.

The Pacific Light & Power Company is now constructing a steam plant at Redondo with two turbo-generators of 16,000 horsepower each, or a total of 32,000 horsepower.

The Southern California Edison Company is now constructing at Long Beach what will ultimately be one of the largest steam plants in the world. It has an installation of eight turbo-generators of 16,000 horsepower each, with 128 boilers of 750 horsepower, giving a total capacity of nearly 150,000 horsepower.

The total of the power which has been developed by private corporations for use in Southern California since 1906 available for use twenty-four hours per day will, therefore, be seen to equal 80,000 horsepower, which is now in use for continuous service.

The capacity of electric generation from the waters of the Owens River is estimated by the aqueduct engineers as 64,000 horsepower available for all hours of the day. By storing the water-power during the early hours of the morning, it will be possible, however, for the waters of the aqueduct to generate a total output of 120,000 horsepower during the evening hour when the demand reaches its maximum.

Three events of predominating importance to those engaged in the electrical business and the public, have transpired during the year 1910. They are as follows.

The announcement a few weeks ago that the Southern Pacific is to electrify all of its suburban lines as well as lines leading to near-by cities, coupled with the prospect that electricity may be used as motive power for even longer hauls, changes materially the aspect of the generating proposition and puts a new phase on the question of supply and demand. The program announced for immediate electrification by the Southern Pacific Railway includes the following:

The coast line to Ventura (with perhaps an ultimate extension of the trolley system to Santa Barbara), 110 miles.

The line from Los Angeles to Ontario, including the line to Pasadena, and from Dolgeville to Duarte, and a loop between Savannah and Pomona.

Another part of the system planned to undergo similar transformation at an early date includes the line from Los Angeles to San Pedro and Long Beach, together with a system of tracks terminating in a double loop taking in West Anaheim, Anaheim, Tustin, Santa Ana, Newport Beach and Los Alamitos. The steam line projected to Santa Monica and built to the Palms is also to be electrified, affording a new outlet for trolley lines to the Arcade Station. The electrification of these steam lines will add about 300 miles to the 1000 miles of trolley trackage included in the lines taken over by the Southern Pacific.

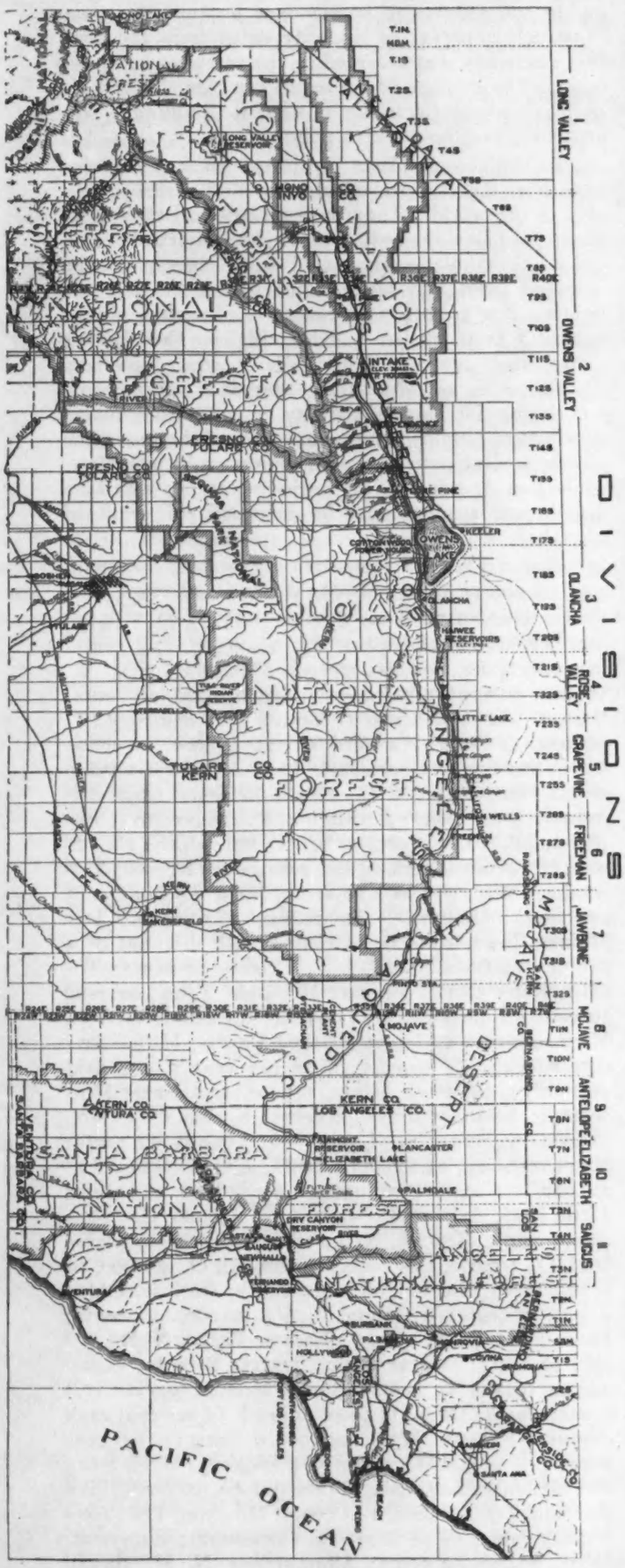
An electrical engineer conversant with the traffic on the lines which it is proposed to electrify and those which will probably be added to the program as announced, estimates that it will require approximately 40,000 horsepower per day to operate them. The estimated generating capacity of the flow of the Owens River Aqueduct is 64,000 horsepower, and it will thus be seen that the electrification of the lines of the Southern Pacific as above indicated will require electric power equal to about two-thirds of the entire available output of electricity from the Owens River, thus materially changing the basis of estimate of the available hydroelectric energy in Southern California.

Next in importance is the enormous appropriations decided upon by the electric companies for steam auxiliary plants. This construction, either under way or arranged for during the past year, will, upon completion, aggregate $8,000,000.

This seems remarkable in the face of the fact that the time is rapidly approaching when electric generation from the waters of the Owens River will be available. The answer is to be found in the fact that the officers, managers and experts of the private electric companies have learned by experience that service dependent entirely upon water-power generation is unreliable to the extent that it is subject to the destructive forces of floods, and washouts, and that long transmission lines are menaced by many forms of interruption. To guarantee electricity to merchants, manufacturers and large consumers, whose business is absolutely dependent upon the constancy of light and power, it is necessary as a business proposition, to supplement all hydroelectric energy by a battery of steam plants equal to keep the load up to its maximum demand in the event of any emergency.

The peak load for demand averaging between 5 o'clock and 9 o'clock in the evening also has to be forced up by steam-generated electricity.

It logically follows that in a possible contest for business between a system dependent entirely upon electricity generated by water and subject to the vicis-



Map of Los Angeles Aqueduct and Adjacent Territory.

situdes of weather, and a system which can guarantee the merchants and manufacturers that their stores would be lighted and the wheels of their industries supplied with power through auxiliary forces of steam generated, that the unsupported water-power would suffer in competition.

Electric power is already being generated from the upper waters of the Owens River. Thus far it is used principally for construction, and a small supply is being sold for lighting the village of Independence, Inyo county.

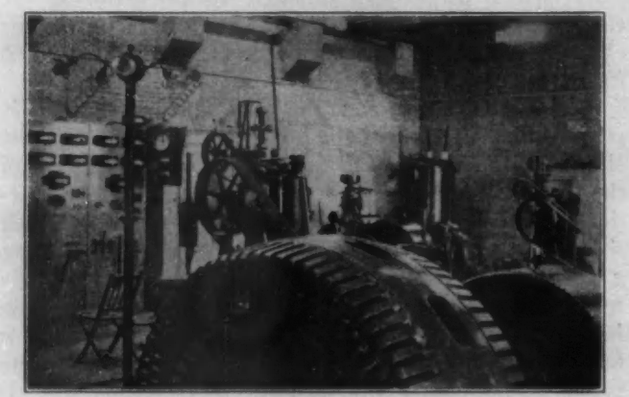
E. F. Scattergood, the electrical engineer of the Aqueduct Commission, says that the city will have at its seven power sites when the development of the Owens River power is completed, available at a central substation, a net average of 64,000 horsepower, and by the use of reservoirs and regulating devices, it will be possible to deliver for a short period during any twenty-four hours up to a peak load of 120,000 horsepower. This will be accomplished by holding back the water which would flow through the canal during the early morning hours and turning it all loose during about one hour in the early evening when the demand for current for lighting is greatest.

The general plan of the development of electric power along the line of the aqueduct, and its transmission to Los Angeles and vicinity is, in the opinion of the Consulting Board of Engineers, a thoroughly practicable scheme involving no engineering problem which should not permit of successful solution, and promising a reliable source of power, destined to find a ready market at prices advantageous to Los Angeles. Taking at points of departure the aqueduct's surveys for amounts of fall and the reports of stream flows and capacity on which the general aqueduct design is based, the board finds that the total amount of power which can be developed in the vicinity of Los Angeles and ready for sale at step-down voltage is approximately 64,000 horsepower for twenty-four hours to a maximum delivery of 120,000 horsepower. This is substantially 30 per cent in excess of the estimate made by the first Board of Consulting Engineers. The power available at Cottonwood and Division Creek amounting to some 4500 kilowatts was not contemplated or included in the earlier estimates. Final surveys for location with special reference to power development have permitted of more advantageous locations of power sites, thus securing higher heads and a corresponding increase in the power available without increasing the cost of the aqueduct construction. The estimate of cost is less in very marked degree than the average cost of hydraulic power development and installation elsewhere on this coast, and under generally similar physical conditions and surroundings. In the case of the aqueduct project the primary division works are a part of the aqueduct, and the water is furthermore carried along the aqueduct line in close proximity to the power sites. Under these circumstances the cost of hydraulic development for power in connection with the aqueduct should naturally be somewhat less than for the development of water-power independently.

The principal power sites are in relatively close proximity to the city of Los Angeles, and are at the

same time relatively accessible for the transmission and installation of equipment. All extra charges for diverting water from the natural aqueduct line and handling it along the power line has been charged to power development, the same as in the case of diversion from the course of a natural stream for power purposes. In brief, in the distribution of charges between the aqueduct and power project the former is charged only with such features as should be directly necessary for passing the water as an aqueduct.

The experts of the Board of Consulting Engineers assumed that under usual conditions the average aqueduct flow per day would be at the rate of 400 cubic feet per second and that this flow must be maintained or at least permitted whether power is developed or not. With this steady flow the capacity of the power sites at San Fernando and at Haiwee Dam, together with those at Cottonwood and Division Creek feeders, with an average stream flow of twenty second feet and eight second feet, respectively, will provide for a steady development of some 14,000 kilowatts.



Cottonwood Power House—Two 750-kw. Generators—Power All Utilized for Construction Work.

To provide for the variable flow at these sites while at the same time assuring the necessary continuous daily average flow through the entire length of the aqueduct, provision is made for aqueduct storage reservoirs above and below these sites. The function of these reservoirs will therefore be to permit of the regulation of supply in accordance with the demand, while in addition they will have a capacity sufficient to provide a guarantee against ordinary interruptions of service due to incidental repairs on the aqueduct line between the Fairmont and Haiwee reservoirs.

Regarding the program for the development of the Owens power, the consulting board recommends a progressive development at such a rate as the growth of the power market may justify. As a first step, the installation of all such portions of the equipment as may thus be required for the aqueduct project by itself together with the full development of one or more power sites as further study may indicate, is suggested.

The cost of constructing the generating plant as above outlined, without allowing for a distributing system in Los Angeles or elsewhere will, according to the Consulting Board of Engineers, amount to $7,200,000.

The people of Los Angeles and Southern California are probably the greatest users of electric light in the world. In the first place, their homes were built to be lighted by electricity; there was little antique gas piping and fixtures to be removed because the great construction period of this city dates from the time that electricity was accepted by the world as its illuminant. The number of houses in Los Angeles and its environs where electricity is used for lighting is approaching the 100-per-cent point.

In the second place, the people of Los Angeles have now the cheapest electricity in America—probably in the world. They have always had their electricity far below the cost of other similarly conditioned cities. A tabulation compiled from correspondence obtained from fifty-seven cities shows the average lighting rate to be 11.4 cents per kilowatt hour, as against 7 cents in Los Angeles, this city thus having a rate 40 per cent less than the demonstrated average. The following will show the reader what other people are paying for their electricity in cities and towns which have obtained their growth, and the extension of whose distributing system is practically complete, while Los Angeles is just beginning to grow and its distributing system must be extended to permit of growth:

New York, N. Y., population 3,000,000, maximum rate 10 cents; Brooklyn, N. Y., 1,600,000, 12 cents; Rochester, N. Y., 210,000, 8 cents; Buffalo, N. Y., 415,000, 9 cents; Philadelphia, Pa., 1,500,000, 13.5 cents; Pittsburgh, Pa., 600,000, 10 cents; Washington, D. C., 350,000, 10 cents; Baltimore, Md., 650,000, 10 cents; Boston, Mass., 630,000, 11 cents; Providence, R. I., 215,000, 12 cents; Hartford, Conn., 105,000, 11 cents, (cash discount of 5 per cent); Portland, Me., 65,000, 9 cents; Manchester, N. H., 70,000, 12 cents, (cash discount of 5 per cent); Burlington, Vt., 20,000, 10 cents; Richmond, Va., 116,000. 10 cents; Raleigh, N. C., 15,000, 13.5 cents; Chicago, Ill., 2,600,000, 12 cents; Milwaukee, Wis., 375,000, 12 cents (cash discount of 5 per cent); Madison, Wis., 20,000, 14.5 cents; Des Moines, Iowa, 100,000, 12 cents, (cash discount of 5 per cent); Indianapolis, Ind., 250,000, 10 cents; Topeka, Kan., 50,000, 9 cents; Memphis, Tenn., 200,000, 10 cents; Louisville, Ky., 290,000, 8.4 cents; Detroit, Mich., 450,000, 12.6 cents; Grand Rapids, Mich., 110,000, 8 cents, (a penalty of 10 per cent if not paid promptly); St. Paul, Minn., 235,000, 13.5 cents; Minneapolis, Minn., 310.000, 10 cents; Kansas City, Mo., 375,000, 10 cents; St. Louis, Mo., 750,000, 12 cents; Natchez, Miss., 15,000, 13.5 cents; New Orleans, La., 375,000, 17.1 cents; Birmingham, Ala., 40,000, 10.4 cents; Little Rock, Ark., 60,000, 13.5 cents; Atlanta, Ga., 150,000, 9 cents; Newark, N. J., 350,000, 10 cents; Cleveland, O., 550,000, 12.5 cents; Cincinnati, O., 460,000, 10 cents, (cash discount of 5 per cent); Guthrie, Okla., 20,000, 15 cents; Wheeling, W. Va., 50,000, 13.5 cents; Sioux Falls, S. D., 15,000, 18 cents; Fargo, N. D., 15,000, 10 cents; Denver, Colo., 225,000, 8 cents; Boise, Idaho, 10,000, 15 cents; Butte, Mont., 50,000, 11.8 cents; Omaha, Neb., 155,000, 14 cents (5 per cent cash discount); Seattle, Wash., 200,000, 9 cents, (10 per cent penalty if not paid promptly); Spokane, Wash., 50,000, 10 cents; Salt Lake, Utah, 100,000, 10 cents; San Antonio, Tex., 125,000, 14,5 cents; Houston, Tex., 100,000, 13 cents, (5 per cent cash discount); Cheyenne, Wyo., 20,000, 12 cents; Albuquerque, N. M., 10,000,

13.5 cents; Portland, Ore., 275,000, 15 cents, (cash discount of 5 per cent); San Francisco, Cal., 500,000, 9 cents; Sacramento, Cal., 55,000, 9 cents; Oakland, Cal., 150,000, 9 cents.

One million electric lights glow in Los Angeles every night, as shown by the connection records in the city electrician's office.

One thousand and sixty-four electric motors were turning the wheels of industry within the city at the close of the last record year.

It can be assumed that so far as electric lighting is concerned, that its use is almost abreast with the population, and that its increase hereafter will be commensurate with the increase in population. Something over 95 per cent of the total possible residential and business lighting is now done by electricity, but the increase in the use of the motors presents a field of wonderful possibilities. It is daily displacing the steam and gasoline engine for manufacturing purposes, and is making the establishment of manufactories an undertaking requiring far less capital than in the days of the inevitable tall chimney, the costly steam boiler, and the solidly constructed building which was obliged to stand the rack of the steam engine. When Los Angeles takes its place in the ranks of great manufacturing cities of America, the electric motor will be the principal factor in accomplishing the achievement.

The completion of the Panama Canal will, of course, open our ports for the importation of cheaper raw material and the exportation of finished products. It will bring directly to our port the skilled and accomplished textile workers of the Old World who now drift from Castle Garden to the manufacturing centers of New England and the South. The cotton growing industry of the Imperial Valley will become an important domestic source of raw material; push the button, and the electric motor will do the rest.

The increase in the use of electricity for light and power, as shown by the records of the office of the city electrician, since the year 1905 will closely conform to the increase of its use in other cities and towns in Southern California. These records are as follows:

FOR USE AS LIGHTING.

Number of 16-c.p. lamps covered by permits issued during year	1905-6	155,613
	1906-7	135,744
	1907-8	112,299
	7 months 1908-9	79,124
	1909-10	175,840

FOR USE AS POWER.

Number of motors covered by permits during the year	1905-6	783
	1906-7	1,017
	1907-8	698
	7 months 1908-9	511
	Year ending July 1, 1910	1,064
Capacity of motors in horsepower	1906-7	5,240
	1907-8	2,675
	1908-9	2,105
	1909-10	4,817

Fixation of atmospheric nitrogen by arc discharge requires about 28 kw.-hours for every pound of nitrogen bound as nitric acid, whereas 6.4 kw.-hours suffices for one pound of nitrogen held in the form of calcium cyanamide.

INDUSTRIAL ACCIDENTS.

Industrial accidents in the United States take an annual toll of life and limb far exceeding the killed and wounded of several great military campaigns. The statistics given by the Bulletin of the Bureau of Labor for 1908, which must be regarded as incomplete because of the failure to report fully these accidents, show a yearly mortality of between 30,000 and 35,000 adult wage earners alone, and the non-fatal injuries inflicted will roll up the total by at least an additional 2,000,000. These and other arresting statements are made by Mr. John Calder, manager of the Remington Typewriter Works, Ilion, New York, who will at the New York monthly meeting of the American Society of Mechanical Engineers, 29 West Thirty-ninth street, New York, Tuesday evening, February 14th, present a brief for the Mechanical Engineer and the Prevention of Accidents. Mr. Calder believes much can be accomplished by a movement on the part of the profession which has to deal so largely with the planning and working of industrial machinery. Prevention, not cure, is the theme of the paper, which analyzes the causes of those accidents regarded as preventable and describes various devices for guarding equipment and processes, drawn chiefly from the writer's experience in plant management. Mr. Calder considers that one-third of the present rate of mortality can and should be eliminated by such devices.

The causes of preventable accident are, in Mr. Calder's belief, chiefly ten, ignorance, carelessness, unsuitable clothing, insufficient lighting, dirty and obstructed work places, defects of machinery and structure, and absence of safeguards, and with each of these he deals in turn, showing how they may be eliminated. Engineers are largely responsible in these cases since to them usually falls the control of such plants, and the matter should be made one of scientific study by them.

Under the head of safeguarding, the author has many interesting views of equipment and machinery, showing the use of such devices on gears, steam turbines, lathes, cotton carders, rolling mill engines, transmission tubes, belts, variable diameter converting saws, log saws, constant diameter overhung saws, press feeds, calendaring machines, grinding wheels, etc. He also takes up in detail especially dangerous machines and processes which present difficult safeguarding problems for the engineer. Under the first head he presents only four, which may be regarded as typical; wood working saws and cutters, punches and presses, rolling machinery of all kinds where hand feeding is necessary, and emery and other grinding wheels, all of which he fully illustrates. Dangerous processes where the risk is not purely mechanical involve enforcing of rules, such as never to clean a machine while it is in motion; the placing of machines in locations that will not endanger passers-by; protection of open stairs and gangways, of open vats containing chemicals, and of vessels which are likely to burst. The author further recommends the continual inspection of these safeguards, the education of the workmen rather than the prevalence of many "take warning" signs which go unread, and providing of first aid services in the case of every accident.

POSSIBILITIES OF LOGGING BY ELECTRICITY.

In an article in the Pacific Lumber Trade Journal, Seattle, Wash., Frank Mackean describes the application of electricity to the homely task of logging. He assumes that there is a small brook near the tract of timber, and that upon examination it is found to be 4 ft. wide, 1 ft. deep and flowing 4 ft. per second. There is hardly a good sized body of timber on the coast that does not boast of one or more of such streams, quite often many times larger.

The topography of the country is such as to make it comparatively easy to find a place in the stream where the banks are high and the gorge or bed of the stream is narrow enough to locate the dam or diversion works. This point should be selected with a view of a good foundation for these works, shale, clay or rock being necessary to make the structure reliable.

The next step is to determine the head, or the height in feet, that can be utilized in the fall of the stream. As a hypothetical case assume that in its course of 1000 ft. down the valley the brook falls an even 100 ft., and that the diversion works has raised the water another 10 ft. above the bed of the stream, hence, between the level of the pond and the site of the power plant is a difference of 110 ft. Water-power is proportional to the amount of water in a stream, times its fall in feet, reduced to foot pounds and then to horsepower.

In the case of the supposed stream above the value is reduced to horsepower as follows:

Find a place where the stream is fairly straight and has a well defined channel free from boulders and obstructions for 50 ft. or a 100 ft. of its course and measure off one of them, marking them by a stake. In this stretch at an average width point of the brook measure the width of the stream, which will be found 4 ft. wide, then every 6 in. across the stream measure the depths and by adding the seven measurements together it will be found that the average depth of the stream is 1 ft. The next step is to determine the velocity of the flow. To do this fairly well a common one-half pint flask, or a 1 or 2 lb. bottle, will be found good, but a stick about 6 in. long and 1 or 2 in. thick with a small stone tied on one end will answer the purpose. In either case the float should be so ballasted as to ride well immersed in the water. With watch in hand time this floating bottle or stick between the points marked on the bank of the stream by trying it three times and then calculating this time by the average of the three readings. We will assume that in this case it is 4 ft. per second or that the float traveled the 100 ft. in 15 seconds, or the 50 ft. in 7½ seconds. We are now in possession of the data from which to calculate our power. We do this by multiplying the width by the depth, equals 4, by the velocity of the stream, 4 ft. per second, equals 16, which is the number of cu. ft. per second in the stream, and this multiplied by 60 equals 960 cu. ft. per minute. The power factor is further determined by multiplying the head or fall as represented in this case as 110 ft. by the 960 which gives us 105,600 cu. ft. of water. As the weight of one cu. ft. of water is 62½ lb., we reduce this water to foot-pounds by multiplying the two, which gives us a quotient of 6,600,000 foot-pounds. As the equivalent of one horsepower is 33,000 foot pounds we divide the first by the last with a result of 200 horsepower. This is the theoretical horsepower only. As a matter of fact, the transfer of this force into power entails losses, and actual practice shows that these losses average fully 30 per cent of the total theoretical horsepower of the stream. These losses are found in the friction of the water in the flume, pipes or races; the water-wheel; and also in the electrical machinery and wire line used to distribute the power. In this case we will have lost 60 horsepower, leaving us 140 horsepower available for real use.

The next step is the conversion of this power, which is accomplished as follows:

Assuming that the improvement is to be made solely for the purpose of logging off the land and in no sense to be permanent; the diversion dam can be constructed of logs, built of the gravity type planked on its upper slope with tongue and grooved 2-inch flooring and the intake pipe placed at least 3 ft. below the proposed dam water level. A spillway over the crest of the dam or around it should be provided, ample to carry any flood waters that may come down the stream, and care should be used to see that the discharge in the stream is far enough below the dam to not undermine it.

The next step is the pipe line. As we have 16 second feet of water, and 6 ft. per second is about the economical limit of velocity in a pipe line we will require an 18 in. pipe to carry the water down the 1000 ft. of slope from the dam to the power house. Time was when the placing of a continuous wood stave pipe was a specialty that was taxed against the user at a rate that left a question as to its final economy, but the planing mill and local sawmill have made it a simple matter to get out the material for such a pipe as above noted. By taking a common rough 2x4 and planing it on two edges and one side, beveling the edges slightly, the staves can be easily prepared for this pipe. To secure the necessary bevel draw an 18 in. circle on a piece of paper, then another one 22 in. or 2 in. from the other; take a pair of compasses or dividers and space the outer circle into 18 equal spaces. Then from each scribed point on the circle draw a straight line to the next point and so on clear around the circle. Then from each of these points draw a line to the center. Then from the intersection of the inner circle and the radial lines draw another set of lines. These will divide your circle into 18 segments having plane sides. One of these segments is the pattern for planing your staves and allowing ⅛ in. for planing in thickness, another ¼ in. for planing two edges will give us for our stave dimensions as finished, 3⅝ in. on the outer side and 3⅛ in. on the inner planed side, the edges being each beveled at the same angle. One sixty-fourth of an inch is allowed in these calculations and dimensions for the shrinkage of the wood which should be cut from fir flooring logs, free from knots that run through or may come on the edges of the beveled stave, and should be put in the line fresh from the mill and planer, green. The bands are made simply by cutting a 4 in. thread on ⅜

in. round iron rods and swedging a head on the other end and bending them around the formed pipe and using a lug to make the connection, using a socket wrench to set up the nuts and thus tighten the round iron hoop. These should be spaced from 4 in. to 1 ft. apart as the pressure comes on the pipe line. All stave joints or ends should be made by taking a hand-saw and sawing a scarf across the end of the stave 5/8 in. deep and inserting an 1¼ in. wide by 3⅜ in. long strip of No. 16 gauge hoop iron into it and the stave next following it, also similarly sawn. Care should be used to see that the hydraulic gradient is not departed from in laying the pipe line or you will have a severe loss of head in your plant.

The water-wheel may be of the horizontal turbine type fitted with an automatic governor, and for the particular development here outlined should be a 12 in. wheel with steel case and steel draft tube, and set 8 or 10 ft. above the tail race or ditch carrying the water away from the wheel.

The next step is the power house, which can be built the same as the other camp buildings, of rough lumber. The only extra care needed is in preparing the foundation for the water-wheel and electric generator, which should be firm and well set. Concrete could here be employed to good advantage even for a temporary plant, but logs cribbed and drift bolted will answer if properly placed. The generator should in this case be a 150 h.p. direct current machine of the multipolar type, 600 volts, and direct connected to the water-wheel. This is important, as a compact installation is necessary and one that is as near "fool proof" as possible and the entire plant should be as nearly self-regulating as it is possible to make it. The switchboard, a marble slab set on an iron frame at one side of the room housing the power plant, should carry one or more switches, an automatic circuit breaker, and a voltmeter and an ammeter with a pilot light, and a rheostat. The wiring can be either single or double circuit as the conditions may warrant. By grounding one side of the electric machine and one side of the motors, one wire is all that will be required for operating the system. The wires should be rubber covered and double braided to protect the insulation from abrasion and then a cheap wooden bracket and glass insulator can be tacked to the trees to get it to the point of usage.

The next step in the equipment is the electric donkey. This is substantially the same in the arrangement of drums and drum control as the steam outfit, but the frame is made only long enough to carry the drums, and under the main shaft (which in the steam donkey is the engine shaft) the iron-clad electric motor is bolted in and a gear is keyed to it and meshes into the pinion on the motor shaft. Under the haulback drum is another small drum which is fitted with two friction contacts and carries coiled thereon a duplex braided specially insulated stranded electric cable which supplies the donkey with electricity. With this equipment the machine can be moved around in the woods by its own power exactly the same as the steam outfit.

The cut-off electric saw consists of a small one-half horsepower motor geared to an 8 ft. cross-cut or falling saw with a frame fitted with hinged tripods that are set up on the ground and fastened to the tree to be felled, in such a position as to allow the saw to work properly. The current is supplied to the motor by a feed wire of the same design as that on the donkey. One man only is required to operate this and in thick timber he could easily attend to three as well as one. This outfit will do the work of five men easily. The same saw can be used to "buck" the trees into logs, as the tripod is adjustable to make the saw operate either horizontally or vertically.

The foregoing makes up a complete electric logging outfit from the brook to the skid road or delivery point of the "yarder"; and in this article we propose to confine ourselves to this division of the logging problem only.

The next and most vital question to answer and digest is the cost of the electric system of logging.

Intake and dam	$ 50.00
Pipe line, 18-inch wood stave (continuous), laid	640.00
Water-wheel, installed (200 h.p. capacity)	300.00
Power house, shed construction	150.00
Electric generator and station instruments (d.c.)	950.00
Wiring (say ½ mile)	400.00
Total cost, ready to operate	$2,490.00
Electric donkey, complete, with 50 h.p. motor geared 8 to 1, with same drums and equal to a 9x10 in. steam outfit and guaranteed to do the same class of work	950.00
Electric falling and bucking saw, takes one man to run it; will do the work of 5 men	150.00
Complete equipment up to roader point in logging operation	$3,590.00
To this amount should be added for 65 h.p. "roader" donkey, the sum of	1,150.00
Extra line construction for same	250.00
Making the total outlay for a complete electric outfit to deliver logs, say 3000 feet	$4,990.00

To operate this outfit will require the following fixed costs, to get an outfit of 80,000 feet of logs per day:

Interest on investment, at 10 per cent, to cover contingent extras, $490 per year, or per day of 300 working days in year	$ 1.66
Depreciation, 5 per cent	.84
1 Electrician at power house	4.00
2 Electricians at donkeys ($4.00 each)	8.00
2 Choker men ($3.00 each)	6.00
1 Sniper	3.00
1 Chaser	2.50
3 Rigging slingers ($3.50 each)	10.00
1 Signal man	3.00
1 Faller and bucker to operate electric saw	3.50
	$39.00
To this add another $2.00 for repairs especially chargeable to the electric equipment	2.00
And we have as the total daily cost of operating	$41.00
Or a cost of 51¼ cents per thousand from the tree to the water, on 3000 foot delivery.	

Against this electric showing we have the digest of logging costs by steam under average conditions as published in the October, 1910, "Timberman," by Mr. J. P. Van Orsdel, of Portland, logging engineer:

Cost of falling and bucking by hand, 1000 feet to log, average	$0.55
Yarding same, 900 ft. haul, 1000 to log, average	.65
Roading same, 3000 ft. average haul	.30
Total cost per M	$1.50

He gives the capacity of the machines at from 50 M. to 75 M. per day of 10 hours.

He also gives the crews for this daily output, as follows:

Two sets fallers, three buckers.

For the yard engine crew he gives one driver, one firemen, bucker, one chaser, one hook tender, two rigging slingers, one swamper and sniper, and he figures their time at $26 per day.

His roader crew is given as one engineer, one fireman, one wood bucker, one chaser, one grab man, at a cost of $32.50 for labor and upkeep, etc.; so we will have to assume that the same schedule of wages has been used as for the yarder crew. This would make the labor account as follows:

Engineer, $4.00; fireman, $3.50; bucker, $3.00; chaser, $2.50; crab man, $3.00, making a total of $16 per day, which certainly shows a large allowance.

In his analysis of the upkeep of the yarder he also allowed $10 per day. There is a wide division of opinion as to these costs and we feel inclined to split them in half to arrive at the comparative figures.

4 Fallers, at $3.00 each	$12.00
3 Buckers, at $3.00 each	9.00
Yarder crew	26.00
Roader crew	16.00
Yarder upkeep (½ estimate)	5.00
Roader upkeep (½ estimate)	8.25
At a total daily cost of	$76.25
As against the electric cost of	41.00
Leaving a net daily saving of	$35.25

One manufacturing company claims a saving of $250 per month per donkey as against steam equipment, and the cost shows simply an adaptation of a steam outfit which was not as good a showing as can be made with an outfit such as we have outlined.

The prime factors in favor of the electric rig, are its wonderful flexibility, thus saving fully 50 per cent in the wear and tear of your rigging and machinery, its speed in operation and the great saving in labor that it makes. We have frequently heard the logger assert that the logs sawed up for wood for his donkey were of no particular value, but personal investigation has shown that they will average No. 2 logs and this will make the timber consumption on the basis of the value of this grade for the roader and yarder per day at least $12; add to this the wages of the two firemen, $7 per day, and the one-half time of one wood cutter and one full time at $4.50 per day. Add to this the additional cost of the wear and tear on the machinery caused by the use of steam and you have a convincing array of comparative figures in favor of the electric outfit.

But the usefulness of this great power does not stop in the logging camp here. The blacksmith can use it to weld his iron, the cook can use it in an electric cook stove that can be built to provide food for 30 men for the cost of a common range, and save time and money every turn of his work. The tram road can be fitted with a motor car to haul logs to the connecting railway or tide water or mill and all at no additional cost for the electricity, as 55 h.p. for the bucking and falling and yarder outfits and 65 h.p for the roader outfit leaves a margin of 20 h.p. for these camp economies.

Keen intellects are ever busy striving to shave a dollar here and a cent there from the cost of harvesting the rich yield of fir and cedar from the hills and valleys of this wonderful country and modern engineering has furnished the key to the greatest saving of them all by showing the logger how to make the tumbling hillside brook saw down his trees, with an electrically driven motor saw, "buck" them into logs by the same rig, and then "yard" or assemble them with the electric "donkey" to the skid road, fore-and-after or the electric tram, where a similar electric "donkey" delivers them to the mill, connecting railway and waterway, with a celerity, speed and economy that is at once the marvel and delight of the lumberman and expert woodsman.

In conclusion, the advantages of the freedom from danger of fires is one of the greatest points in favor of the electric outfit, and another great source of saving is that no water supply is needed for the donkeys.

LUBRICATING OIL.

The report of the use of lubricating oil in the electric and air compressor plants at the Panama Canal during the month of November shows a marked advance in economy in the use of oil in these plants, and a favorable record as compared with lubrication of similar plants in the States.

In the air compressor plants at Rio Grande, Empire and Las Cascadas there are 14 compressors; rated horsepower of each compressor, 425; steam pressure, 125 pounds, steam end of engines, double cylinder, simple; air end, double cylinder, cross compound; area of two steam cylinders, 9.42 square feet; area of high pressure air cylinders, 9.42 square feet; area of low pressure cylinders, 15.17 square feet; speed of compressors, from 127 to 137 revolutions per minute. All engines are equipped with individual lubricators on steam cylinders, and on each valve on the air end. The return oiling system is in use on all bearings, and engine oil is filtered before returning to the supply or pressure tank. The reports for each plant show:

Rio Grande—Valve oil used, 27¼ gallons; revolutions per gallon, 275,332; square feet of area rubbed over per pint of oil, 1,296,752. Air compressor oil used, 37 gallons; revolutions per gallon of air compressor oil, 202,770; square feet of area rubbed over per pint of oil, 1,246,516. Stationary engine oil used, 33¾ gallons; revolutions per gallon of stationary engine oil, 222,481. Plant of five compressors runs 10½ hours per day, except Sunday.

Empire—Valve oil used, 71 3/10 gallons; revolutions per gallon of valve oil, 256,577; square feet of area rubbed over per pint of valve oil, 1,208,492. Air compressor oil used, 73½ gallons; revolutions per gallon of air compressor oil, 248,723; square feet of area rubbed over per pint of air compressor oil, 1,529,-064. Stationary engine oil used, 84½ gallons; revolutions per gallon of oil, 216,346. Plant of five compressors runs 22½ hours per day.

Las Cascadas—Valve oil used, 25 gallons; revolutions per gallon of valve oil, 256,732; square feet of area rubbed over per pint, 1,209,188. Air compressor oil used, 28 gallons; revolutions per gallon, 229,224; square feet of area rubbed over per pint of oil, 1,409,-154. Stationary engine oil used, 40 gallons; revolutions per gallon, 160,456. Plant of four compressors runs 10½ hours per day, except Sunday.

The consumption of oil at Balboa and Empire electric plants was: Balboa—Valve oil, 33 gallons; stationary engine oil, 20 gallons; air compressor oil, 10 gallons. Empire—Valve oil, 17 gallons; stationary engine oil, 15 gallons.

GAS-PRODUCER ENGINES IN MEXICO.

There is a growing market in the San Luis Potosi district for suction gas engines, otherwise known as gas-producer engines, and the field is being cultivated by European manufacturers with more assiduity than by Americans. These plants are coming into use for pumping, ice making, small electric light plants, milling, and general manufacturing, and are replacing small steam engines. The efficiency and economy of the producer engine make it most suitable for this district, where fuel is expensive, and where the saving in water is also worth considering. It is estimated that the production of 100 horsepower by suction gas engines costs but one-third of steam power, and that such an engine, costing $7500 gold, can be run at a saving which will pay the first cost in less than two years. This type is peculiarly adapted to conditions on this plateau, where no water power is available, where small plants are desired at isolated points, and where economy is of vital importance.

Manufacturers in the United States, where power is cheap and readily rented, can scarcely realize that here it is a necessity in character but a luxury in price. If this whole district is to be developed and industrially modernized it can not be done with steam or with steam-produced electricity, or with large central plants, but with the suction gas engine. The United States is the logical source of supply for these engines, but it must be said that American manufacturers have not maintained their customary and rightful superiority in the development of this form of plant, which is largely a product of the past 10 years.

A steam engine cannot be sold to an importer here who can afford to buy a gas suction engine and who knows its capacity and results. The fact that the demand for these engines is being largely supplied by others, should be sufficient notice to American manufacturers that they are slighting an opportunity in a line in which they should lead the world.

The demand here is for plants of from 25 to 500 horsepower. Up to 200 horsepower single engines are preferred; above 200 horsepower separate units are found practicable, although these engines have been installed up to 650 horsepower.

It is to be noted that at this altitude (6000 feet) there is a diminution of from 18 to 20 per cent in efficiency, as compared with results at sea level. The engine must be heavy enough to absorb all shocks, probably not less than 18 tons for 100 horsepower; it must be accurately fitted in all its parts, and the strength and weight of parts must be adapted to the strains to be put upon them. Finally, the plant must be sold upon terms to allow the purchase price to be paid out of the saving effected by its use. German firms have in some cases allowed three years for full payment, or, as one dealer says, "they allow all the time asked for."

In an engine for this market reliability is the prime necessity; repairs and waiting for parts are exceptionally embarrassing; while simpler parts can be made in this city, it requires time, and suspension in an irrigating or water-supply plant is very serious. The planter, miner, or manufacturer will not take chances on his plant breaking down, if he can help it.

The American manufacturer is accustomed to making engines for localities where fuel is cheap and labor high; here these conditions are reversed, fuel is high and labor low, and the points needing power are isolated and processes intermittent, so that power in wholesale quantities is impracticable. The price of fuel is a handicap to power-producing processes on one hand, and the low price of labor further cuts down the margin of economy in machinery. Power must be economically produced in quantities to suit the demand in order to show a saving over hand labor.

A large machinery house in San Luis Potosi recently imported a small ice-making plant from the United States, but was obliged to buy the engine in Europe, much against its inclination, as the house is American, and has installed eight of these plants in this territory. There is much American machinery that meets little competition here, but the case is different with gas-producer engines.

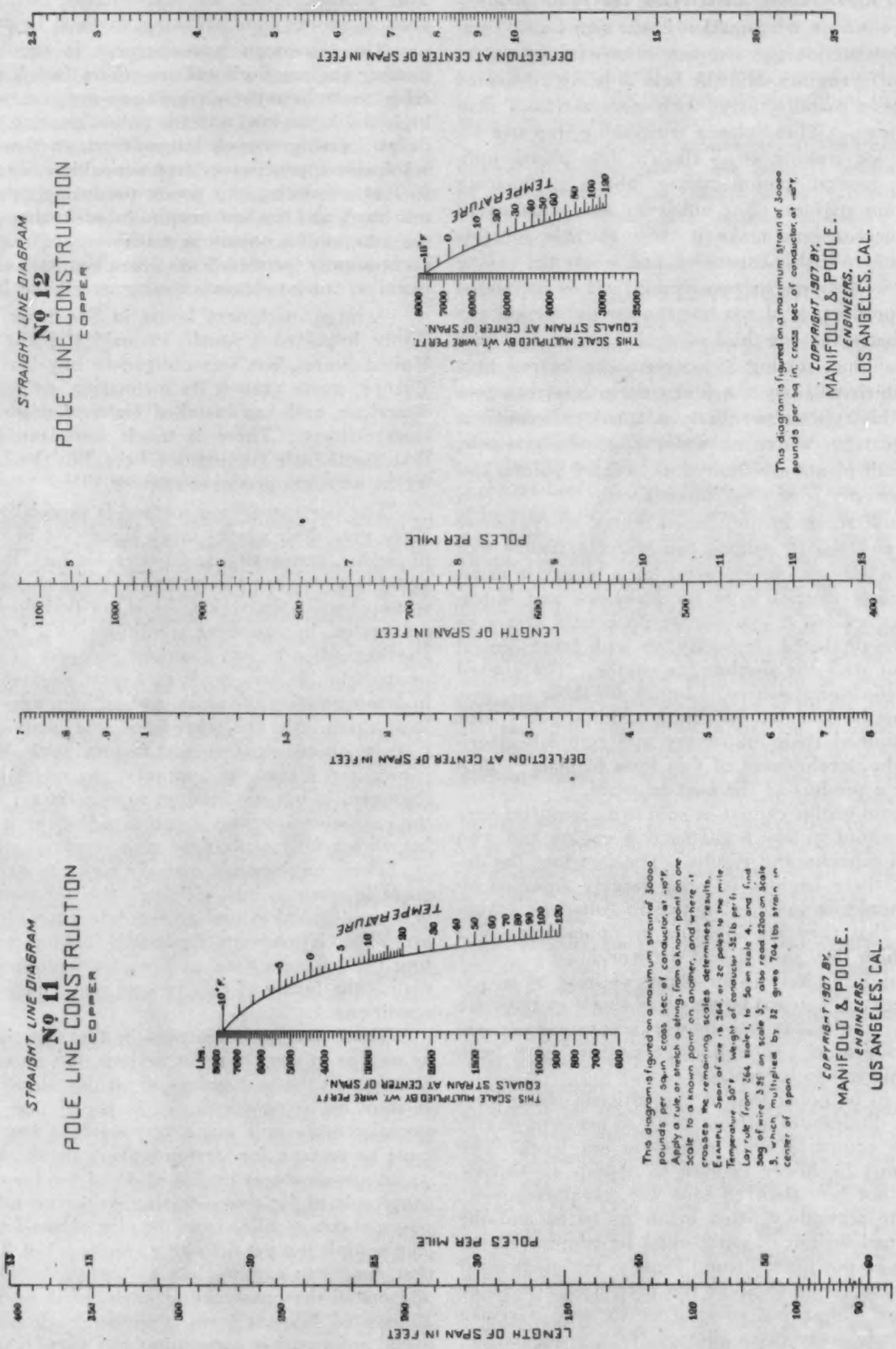
The German selling method is especially effective. They give their agents much discretion in the matter of credits, guaranties, and prices—in fact, the German agent is more than a salesman of these engines; he has administrative discretion; he is not tied down to rigid net prices; he can meet conditions to a large extent. Further, when he has a serious prospect of a sale and needs help, his firm sends an expert engineer to assist in demonstrating the plant, and without expense to the local agent. On the other hand, the American manufacturer quotes a net price at factory, with short credit, if any, and a guarded guaranty, the result being that the agent is left no freedom to negotiate. This gives the customer a strong impression that he is not dealing with a fully authorized representative of the firm.

These engines are scarcely past the experimental stage in many points, although their economy of fuel is beyond question, and an absolute guaranty is necessary. The Germans are apparently looking more to getting the business than to immediate profits, and they realize the future of this type of plant under Mexican conditions.

There are good features in the American model as well as in some foreign designs, but an engine embodying all the best points of all the successful types remains to be produced. It is hoped that American manufacturers will make this combination, but they must be prompt, for foreign makers are much alive.

A gas-producer engine plant of 700 horsepower is contemplated for concentrating works for mining purposes, about 40 miles from the city of San Luis Potosi. The work is not yet definitely specified, but it is known that American engines will be preferred. [Name and address of the constructing engineer is on file in the Bureau of Manufactures, together with much other useful information concerning gas suction engines in San Luis Potosi.]

Man-power on the farm is estimated to cost about 11 cents per hour, animal horsepower about 8 cents per hour. Electrical power costs less and depreciates less.


STRAIGHT LINE DIAGRAM
No 12
POLE LINE CONSTRUCTION
COPPER
DEFLECTION AT CENTER OF SPAN IN FEET
TEMPERATURE
THIS SCALE MULTIPLIED BY WT. WIRE PER FT. EQUALS STRAIN AT CENTER OF SPAN.
This diagram is figured on a maximum strain of 30000 pounds per sq. in. cross sec. of conductor, at -10°F.
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LOS ANGELES, CAL.
POLES PER MILE
LENGTH OF SPAN IN FEET
DEFLECTION AT CENTER OF SPAN IN FEET
STRAIGHT LINE DIAGRAM
No 11
POLE LINE CONSTRUCTION
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TEMPERATURE
THIS SCALE MULTIPLIED BY WT. WIRE PER FT. EQUALS STRAIN AT CENTER OF SPAN.
This diagram is figured on a maximum strain of 30000 pounds per sq.in. cross sec. of conductor, at -10°F.
Apply a rule, or stretch a string, from a known point on one scale to a known point on another, and where it crosses the remaining scales determines results.
Example Span of wire is 264. or 22 poles to the mile. Temperature 30°. Weight of conductor .32 lb per ft.
Lay rule from 264 scale 1, to 30 on scale 4, and find Sag of wire 3.35 on scale 3, also read 2200 on scale 2, which multiplied by 32 gives 704 lbs strain in center of span
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ENGINEERS.
LOS ANGELES, CAL.
POLES PER MILE
LENGTH OF SPAN IN FEET

POLE LINE CONSTRUCTION.

The accompanying diagrams are republished by permission from Manifold & Poole's "Straight Line Engineering Diagrams" (Technical Publishing Company, San Francisco), which contain similar solutions of many other problems in electrical and hydraulic engineering. These diagrams require no other explanation than the directions given to find the strain to which copper wire of known weight is subjected by a given span length and deflection at various temperatures. No. 11 covers spans from 85 to 400 ft. and No. 12 from 400 to 1100 ft.

STREET RAILWAY FRANCHISES NOT EXCLUSIVE.

An interesting case, covering street railroad franchises, has been decided this week by the United States Circuit Court of Appeals in the matter of the appeal of the Seattle Electric Company against the Seattle-Renton and Southern Railway Company.

According to the facts set forth in the decision, the defendant corporation operated a street railroad in Seattle. Rainier avenue being one of the principal streets of the road, under a franchise from the city. Under another franchise a competing road, the Seattle Electric Company, was granted the right to operate a railway over certain rights of way covered by the Seattle-Renton line, on and adjacent to Rainier avenue. The Seattle-Renton Company took the matter into the United States Circuit Court and applied for a restraining order to prevent the building of the competing line. It alleged that the operation of the new road would hamper, obstruct and render inefficient its road; that its earnings would be greatly reduced and the cost of operation greatly increased. It also was alleged that the ordinance granting the competing franchise was obtained by fraud.

Upon these representations the United States Circuit Court granted an interlocutory order restraining the new company from constructing its line and from this order the new company appealed.

The decision holds that the Seattle Electric Company had a right to occupy Rainier avenue, on the ground that a street car line franchise is not exclusive. The city, under its charter, has a right to construct and operate street car lines over its streets, and to grant others the privilege of constructing and operating railways over them. The ordinance is not in conflict with the Constitution of the United States, and the Seattle-Renton Company took its franchise and erected its lines of railway subject to the right of the city to grant to another a franchise, under which it would be authorized to operate a street railway over the streets occupied by the Seattle-Renton.

The decision says that the Circuit Court had no jurisdiction in the matter, and reverses the judgment of injunction, with instructions to dismiss the case.

PROPOSED ELECTRICAL LEGISLATION.

Three bills have been intruduced in the California Assembly by Mr. Kennedy of San Francisco regulating overhead and underground construction and creating the office of a State electrical inspector, which, if passed, would cause the needless expenditure of millions of dollars by the telephone and electric light and power companies.

No. 312 provides that all overhead conductors shall be spaced at least 13 inches from the center line of the pole, specifies that a distance of 4 feet must exist between wires carrying over 600 volts primary, and those carrying less than this voltage, all high tension crossarms to be painted a bright yellow, provides that guy wires and span wires be insulated, insists that vertical pole conductors be encased in wood at least 1½ inches thick, prohibits transformers on electric arc poles, provides insulated or grounded guard wires under circuits of 15,000 volts or more crossing above wires of lower voltage, and provides an additional safety bolt and clamp for suspending aerial cable of 75 No. 19 or 100 No. 22 B. & S. gauge or lower.

No. 313 provides that al electric subways and manholes in which men are to work must be constructed of stone, brick or concrete, equipped with sewer connection, must not be less than 4 x 4 x 5 ft. in size, that their openings must be at least 28 in. diameter or square, and not less than 3 ft. from any street car track.

No. 414 creates the office of a State electrical inspector who shall have had at least seven years' experience as a journeyman lineman. He is to be appointed for four years at an annual salary of $2500 and $50 monthly expense account and to have the power of appointing any number of deputies to see that the above provisions are properly enforced.

While these provisions are ostensibly intended to protect the lives of the electrical workers, they involve the practical reconstruction of almost all electric light and telephone pole lines in all the cities and towns of the State at an enormous expense, merely to provide work for men. To increase the present spacing of 8 in. to 13 in. means the ruination of the smaller telephone companies and the serious embarrassment of all others.

AMERICAN ELECTRIC RAILWAYS.

Ten billion passengers are carried in a year on the electric railways of this country. There are 35,000 miles of electric railway track (single), 75,000 cars, and the capitalization of companies is $4,000,000,000. Their annual income is $440,000,000. They have 250,000 salaried employees. The companies holding membership in the American Electric Railway Association —which is a professional and technical body of practical, operating railroad officials—own 26,425 miles of the above-mentioned track, 66,400 cars, and have a capitalization of $2,693,000,000. They carry 7,000,000,000 passengers yearly, almost five times the population of the earth! These gigantic figures and their significance were discussed at a banquet given to the American Electric Railway Association by the Electric Railway Manufacturers' Association, an affiliated body, in New York, the other evening at the conclusion of the former's midwinter meeting. In was shown, too, that within the next ten years the existing traffic will, in all probability, be doubled. Moreover, the steam roads which, like the Pennsylvania, New York Central and New York, New Haven and Hartford railroads, have already electrified divisions of their main lines, as well as the steam roads entering Chicago, will, a decade hence, have carried electrification over a mileage which at the present time would seem incredible. Steam roads having electrical divisions are admitted to membership in the Association. Only twenty-five years ago not a mile of electric track existed anywhere, not a dollar was invested in the business. Electric traction is the largest, and perhaps the most wonderful of the new industries.

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POWER AND GAS

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NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July 1895.
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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Exploiting Public Needs

"The public's needs should be served, not exploited," we said last week. Whereat several have objected that exploiting, or explaining in detail, is the only way in which these needs can be made known. Street railway patrons expect safe, rapid and convenient service in cross-seated cars, comfortably heated and ventilated. These public needs are frequently not obtained until they have been exploited or recounted at length, in the press or by other means of public expression. The Pacific Coast needs more people to exploit, or make completely available, its latent resources. So this journal has always exploited, or explained in detail, all of the power developments in this great country "from the Rockies to the Coast," once exploited, or explored, in quest of gold, but now capable of a more beneficent agricultural exploitation. In all of the above definitions exploitation carries a good sense.

But, just as most of the good things of this life become harmful in excess, so has this good old word recently fallen into disrepute and assumed an evil meaning which has already been given first place in the dictionary. If to satisfy the needs of street railway patrons it is necessary to sacrifice a valuable franchise which in turn becomes the basis for increased capitalization, and if the immediate necessities of the Pacific Coast are forced to pay a heavy toll of passenger and freight rates, then these needs are being utilized or employed in selfish schemes, they are brought out for the company's own advantage without regard to the rights of others, in short, they are being exploited.

It is unnecessary to here dwell upon the thousand and one ways in which a public service corporation can thus exploit the needs of its consumers. Whether they appear as bribery of public officials, interference in political nominations and elections, "fixing" of juries and judges, or in the greatest of all curses, over-capitalization, the practice is radically wrong and must be stopped. Closely allied to these actions contrary to the general public welfare is corporation advocacy of the policy of an "open town" in order that "owl" cars may prove profitable or that electric light and power may be used all night.

We well understand that the public service corporation is usually an unwilling party to these corruptions and is "held up" by predatory politicians who are the real cause of the evil. As long as the corporation is subject to local municipal control, so long will these abuses continue. The logical remedy is to vest the power of rate-regulation and franchise-granting in some State organization, such as a public service commission, whose members are technically qualified to handle the specialized problems involved and who are free from all political domination. Here the Governor, as the apointive official, is the responsible party.

PERSONALS.

C. F. Adams, president of the Portland Gas Company, is a San Francisco visitor.

G. McM. Ross, a mechanical engineer, was at San Francisco from Stockton this week.

T. C. Winck of the Tacoma Traction Company has been spending a few days at San Francisco.

Rudolph W. Van Norden, consulting engineer, has returned to San Francisco from Sacramento.

Clarence H. Howard, president of the Commonwealth Steel Company of St. Louis, is at San Francisco.

James H. Wise, of F. G. Baum & Co., has returned to his San Francisco office after a Northern California trip.

John Martin, president of the Coast Counties Light and Power Company of Santa Cruz, Cal., is spending several weeks in the East,

R. Leo Van der Naillen, superintendent of the Oro Water, Light & Power Company, was at San Francisco from Oroville during the past week.

W. S. Heger, California manager of the Allis-Chalmers Company, has returned to his San Francisco office after a trip to the factory at Milwaukee, Wis.

F. O. Sievers, connected with the sales department of the Pacific Coast branch of the Fort Wayne Electric Works, has been making a tour of Northern California.

Edward J. Nally, vice-president and general manager of the Postal Telegraph Cable Company, is at San Francisco on a general inspection tour of the Pacific Slope.

Sidney Sprout, who recently saved one of the islands in the Sacramento river from being flooded, has returned to his San Francisco office from Virginia City, Nevada.

Wynn Meredith and E. N. Sanderson of Sanderson & Porter, returned to San Francisco from Vancouver, B. C., this week, Mr. Sanderson continuing East after a brief stay.

A. H. Coates of the Colonial Electric Co. is attending the Chicago automobile show in the interest of his numerous Pacific Coast auto supply specialties. He expects to return to San Francisco about March 1, after visiting several Eastern cities.

Fred Poss, of the Holophane Company, and S. B. Gregory of the Arrow Electric Company, were recently presented with silver golf trophies, won at the Del Monte golf links during the Electrical Jobbers' meeting. R. D. Holabird made the presentation speech at the Palace Hotel, San Francisco.

F. H. Ensign has resigned as manager of the Pacific Gas and Electric Company of Phoenix, Ariz., after 5½ years' service. It is his intention to devote his time to personal interests and he has become financially interested in the New State Electric Supply and Fixture Company and the New State Auto Aerial Company and assumes the management of both concerns in addition to other personal interests in Phoenix and throughout the valley. Mr. Ensign retains his identification with the Pacific Gas and Electric Company as consulting engineer. Mr. R. G. Whitmarsh has been elected by the officials of the company to succeed Mr. Ensign as manager.

C. E. Thatcher, the new city manager of the Western Union Telegraph Company, at San Francisco, will have as his assistant C. W. Isaacs, who has been in the company's employ for twenty years. Mr. Thatcher recently arrived from Washington, D. C., where he occupied an important position at the head of the transportation rate section of the Treasury Department. He formerly had considerable telegraphic experience with the Burlington railroad system and elsewhere. He is also an International Exposition man, having represented the United States Government at both the Jamestown and the Seattle expositions in an important capacity.

Harry Curtis Rice, vice-president of the General Incandescent Lamp Co., Cleveland, Ohio, was married on Tuesday, February 7, 1911, to Miss Edna Tyler Kindelon, at Lynn, Massachusetts. The wedding was a quiet affair, attended only by the immediate families, Mr. and Mrs. Rice immediately thereafter taking the steamer from New York to Florida and Cuba where they will spend a few weeks. Mr. Rice's many friends on the Pacific Coast extend him their heartiest congratulations, especially as his bride is a California girl who thus adds another tie to those that already endear Harry Rice to the local electrical fraternity. Mr. and Mrs. Rice will be at home after April 15th, at Harlow Park, 1906 East 105th street, Cleveland, Ohio.

TRADE NOTES.

The Westinghouse Electric & Manufacturing Company has sold the Isthmian Canal Commission two 75 kw. motor-generator sets with a switchboard for the control of each. One of the motor-generator sets will be located in the substation near the site of the Gatun Locks and the other on the Pacific side near the Pedro Miguel Locks. The apparatus will be used in connection with the construction of the lock gates. The outfits will be installed at Gatun and Pedro Miguel and will operate on 25 cycle, 2300 volt energy transmitted from the power stations at Gatun and Miraflores. The motor-generators will convert this alternating current to direct current at 230 volts for use on the various small tools used in the gate construction.

NEW CATALOGUES.

The Banner Electric Company of Youngstown, Ohio, have issued a handsome souvenir description of the Allegheny County Soldiers' Memorial, a most novel and beautiful blending of illumination with architecture and decoration.

The Maxwell Gas Company of San Francisco have issued an interesting catalogue devoted largely to the production and purification of gas from the distillation of wood. This attractive publication was prepared by Mr. J. W. Swaren.

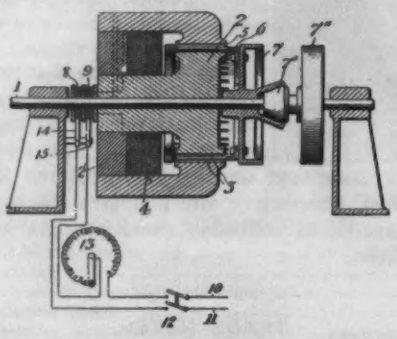
Theo. F. Dredge, representing the Richardson-Phenix Co., at San Francisco, is distributing their Bulletin No. 53, devoted to the Richardson Model "M" Mechanical Lubricator. This bulletin contains valuable data on friction in steam engines and how it may be minimized by proper lubrication.

The Kellogg Switchboard & Supply Co. has issued the second edition of Bulletin No. 32 on cord circuit practice for magneto switchboards. This bulletin is issued uniform with Bulletin No. 54 on party line equipment, the third edition of which is being rapidly exhausted. These two bulletins are written by a practical telephone man who understands the needs of the man behind the switchboard and on the right of way.

The Insulator Book from The Locke Insulator Mfg. Co., is being distributed by Pierson, Roeding & Co. This convenient loose-leaf catalogue of porcelain insulators, gives complete illustrated details of the various types of insulators, both suspension and pin, for all possible service. It furthermore includes valuable data pertaining to pole and tower line construction, wire, line protective devices, etc., as well as full information on tests of insulating material.

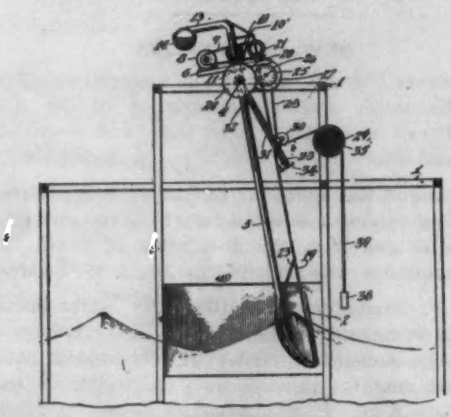
PATENTS

982,789. Electromagnetic Power-Transmitting Mechanism. Augustus Jesse Bowie, Jr., San Francisco, Cal. Power transmission mechanism comprising a positively driven primary element mounted on a rotatable main shaft, and a sec-



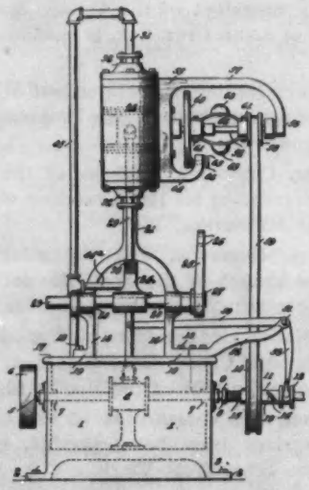
ondary element mounted on a rotatable counter-shaft, out of alinement with the main shaft and driven therefrom, said primary and secondary elements forming an electro-magnetic inductive system involving a magnet having an air gap, and an energizing coil for said magnet, and an electric conductor interposed in said air gap.

982,928. Wave-Motor. Telesphore J. Beaudette, Los Angeles, Cal. In a wave motor, the combination with a wave actuated rocking means, of gearing connected to said wave actuated means, a driven shaft, a connection from said gearing to said driven shaft, for increasing the speed of operation of the driven shaft at the latter part of the operating



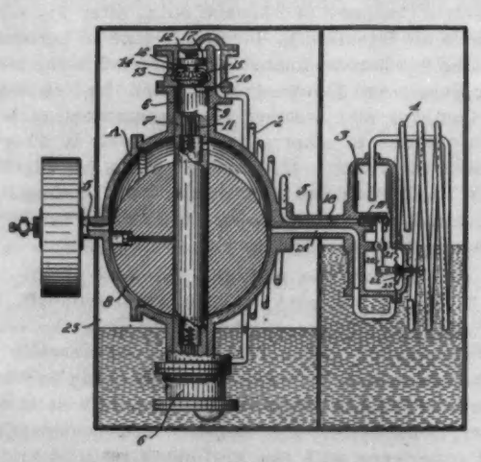
stroke, comprising a drum on the driven shaft, a drum connected to the gearing, a cable winding over said drums to wind off on one of the drums as it winds on to the other, a wheel engaging said cable to deflect it, a support for said wheel mounted to move with the rocking means, and means for adjusting the position of the said wheel on said support to vary the power of the motor.

983,216. Water-Governor. Arthur Dickerson, American Fork, Utah, assignor to Dickerson Automatic Governor Company. A hydraulic governor, comprising a tank, a pump therein, the shaft of the pump extending through the ends of the tank, means for connecting one of the ends with the prime mover, a longitudinally movable pulley on the other end, said pulley having a hub provided with a spiral slot, a pin on the shaft extending into the slot, a peripherally grooved disk rigid with the hub, a governor, a driving connection between the pulley and the governor for operating the same, a cylinder above the pump, a communication between the pump and the center of the cylinder, a plunger comprising a pair of spaced pistons in the cylinder, a hollow piston rod attached to each end of the plunger and extending through the ends of the cylinder, a pipe leading to the tank and having a branch at each end of the cylinder, a sliding connection between each branch and the adjacent end of the piston rod, said rod having an inlet opening in the space between the pistons and a plurality of exhaust openings



at each end of the plunger, a valve stem in the piston rod, a valve on each end of the stem, a double valve at the center of the stem, said valves being so spaced on the stem that when in normal position, the valves will be unseated, an elbow lever having one arm connected with the lower end of the valve stem and the other arm engaging the groove of the disk, a shaft provided near one end with an arm for connecting with the controlling mechanism of the prime mover, and having intermediate its ends a gear sector, and a rack bar on the piston rod meshing with the sector.

983,010. Rotary Compressor. Theodore R. Vinzent and Fred C. Bell, Alameda, Cal. A rotary compressor comprising a horizontally mounted casing having an ovoidal chamber, cylinders fixed to the casing and extending radially there-



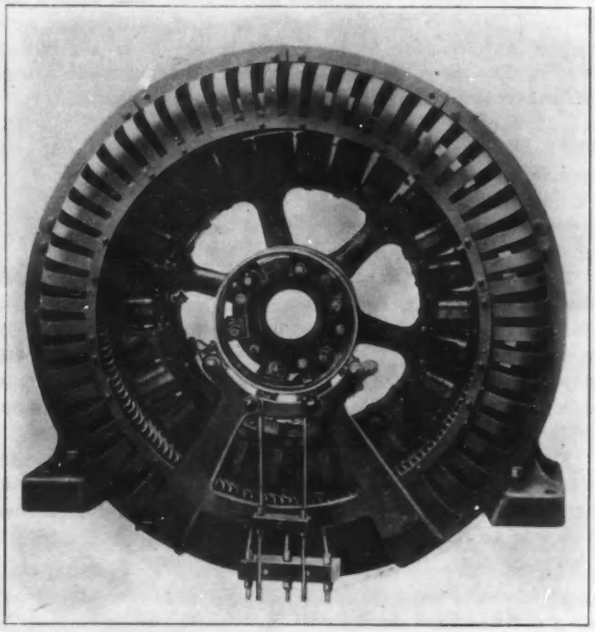
from, a double ended piston extending through said chamber and having its ends operating in opposed cylinders, inlet and outlet valve-controlled passages in the pistons and cylinders, and a weight fixed to the piston between its ends and inclosed by said chamber.

INDUSTRIAL

A.C. ENGINE TYPE GENERATORS.

A line of low speed, 60 cycle, engine type alternators embodying a number of new features of design has been recently placed on the market by the Westinghouse Electric & Manufacturing Company. The line covers capacities from 50 to 1100 k.v.a., 2-phase or 3-phase, and standard voltages of 240, 480, 600, 1200 and 2400 volts. A striking characteristic of the entire line, as shown by the machines already in operation, is the ability of the generators to successfully carry commercial loads of low power factor.

As the general construction and arrangement of parts of the revolving field generator is familiar to all, this description will be confined to the new features of this design, known as the type "E."



Collector End of 75 k.v.a. Type E Generator, 200 r.p.m.

The stator frames are of such design as to give great rigidity and plenty of freedom for the end connections of the armature winding. At the same time the construction is economical of material and affords excellent ventilation. The frame consists of a one-piece casting, except in sizes of such diameter that a split frame is a necessity for shipping reasons. In such cases the halves are bolted firmly together, making practically a solid frame. The frames of the smaller sizes are provided with slide rails on which the frame can be shifted to expose the rotor.

The armature core is built up of laminations of japanned steel of good magnetic characteristics. The laminations are dove-tailed in recesses in the frame. They are assembled under pressure and securely held by finger plates and end plates. Generous ventilating ducts are provided in the core to maintain uniform low temperature. The teeth are firmly supported at each end of the core by finger plates.

Repairs to the armature winding are very easily made because of the design of the winding. The armature slots are open and the coils are held in place by wedges. The coils are interchangeable and are completely formed and insulated before assembling in the core.

The end bells provided for the protection of the armature winding and attached to the end of the frame are of segments built up into circular form and so bolted together that they are light and open, yet rigid and indestructible.

The brush holder brackets, except in the larger sizes, are bolted to the armature frame, which makes each generator complete in itself. On the larger sizes, however, the brush holders are mounted on a pedestal which is to be bolted to the engine bed plate. At least two brushes are provided for each collector ring, which makes it possible to adjust any brush without opening the field circuit.

The rotor consists of a casting with laminated pole-pieces bolted on. The proportions of the casting are worked out with special reference to cooling strains, and the material used provides a homogeneous magnetic circuit. Edgewise wound strap is used for the field coils of all type "E" generators. This makes an ideal construction for field coils as every turn of winding is exposed to the air and heat is readily radiated and dissipated. The insulation between turns is of fire-proof quality.

The entire design of the type "E" generators is arranged for thorough circulation of the air.

The field poles of type "E" generators are so designed that a cage damper winding may be used when desired. Such a winding consists of a series of copper bars embedded in the pole faces, with the ends short-circuited like the squirrel cage winding of an induction motor. The winding serves as an effective damper to any fluctuation and thus tends to prevent "hunting." The cage damper winding is not essential to satisfactory operation, however, when modern steam engines are used as the prime mover. Where internal combustion engines are used the cage damper winding is advisable.

The collectors are of the spider type, consisting of two machined cast iron rings mounted on a cast iron bushing or hub, from which they are carefully insulated. The hub is belted to the rotor spider casting, so that the alignment is entirely independent of shaft adjustments.

Ample factor of safety is allowed throughout the mechanical design and the electrical design is such that overloads and low power factors do not interfere with satisfactory service.

RUGGED MOTORS.

After the explosion and fire which recently destroyed the Los Angeles Times Building, two Bullock motors were removed from the basement where they were lying in 5 feet of water. The presses to which they were attached were completely destroyed and had no value except as scrap iron. The motors, however, were not badly damaged and were practically the only article of value saved from the ruins. In the adjustment of losses made by the Fire Underwriters' Association, 99 per cent of the total insurance was allowed, the 1 per cent saving being based almost entirely on the value of the motors. The life of the insulation of these was destroyed, but the commutators, brush holders, bearings and frames of the machines were in perfect condition. The motors attracted considerable attention and excited much comment because of the fact that they were the only pieces of machinery saved from the ruins. The larger motor is a 60 h.p., 500-volt, 400 r.p.m. machine, while the smaller is a 10 h.p., 450 r.p.m. machine. They are now being re-wound in the shops of the manufacturers, Allis-Chalmers Company, and will be used to drive new presses in the new building which is soon to be erected.

A TESTING CABINET FOR THE SMALL TELEPHONE SWITCHBOARD.

To meet the demand for an inexpensive testing outfit for small telephone exchanges, where a reliable means of testing is absolutely essential but where the outlay for an elaborate wire chief's equipment seems prohibitive, the Western Electric Company has placed on the market a new testing cabinet.

This cabinet, known as the No. 1407, can be used with any switchboard and will do practically the same work as the large and expensive wire chief's desks. It is made in two styles, one for use with magneto switchboards and the other with common battery switchboards. The cabinet is adapted to be fastened to the end of a regular switchboard, or elsewhere, as desired. The voltmeter is mounted on the front of a substantially made oak case, directly above the switching keys. The two terminals for connection to a Wheatstone bridge and the terminals for the grounding and testing cords are arranged at the bottom.

The apparatus consists of a testing circuit, an operator's circuit, a ringing circuit with keys and a grounding cord with flexible cord and plug. Both the testing circuit and grounding cord terminate on eight foot cords, and are equipped with No. 47 cord plugs. With these cords it is possible to reach across and get connection with the lines which terminate in the adjacent switchboard.

No. 1407, Testing Cabinet.

A pair of binding posts placed in the rear of the cabinet provide a convenient means of connecting the telephone lines at the main distributing frame or terminal board, directly with the testing cabinet apparatus. By running a pair of wires from these binding posts to some convenient place near the main distributing frame and using a flexible cord provided with a test plug fitting the protectors, it is possible to test either the switchboard circuit or the outside line.

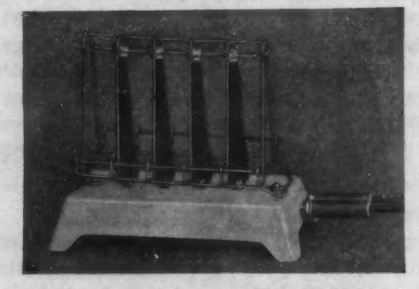
Some of the tests which can be made with this testing cabinet are grounds, opens, shorts and partial shorts, crosses, foreign battery, insulation, leaks, cross talk, loose connections, swinging troubles, earth potentials, poor grounds, open fuses, low resistance ringers across the line, receivers off, voltage of dry or storage cells, location of grounds in motor or generator fields of armature, resistances of receivers, drop coils, relays, etc.

IMPROVED VERTICAL RADIANT TOASTER.

The electric toaster is, perhaps, the most popular of the various electrical cooking devices now available. It is one of those remarkable articles, which so completely satisfies all the requirements of real convenience and utility, that it is rapidly attaining the character of a modern household necessity wherever electric current is available for domestic use.

When the General Electric Company brought out the first vertical type of toaster, its advantages were so apparent that it received quick recognition as ideal in its line. This appreciation was well merited because the new design enabled the making of two slices of toast simultaneously, greatly reducing the time and cost, and increasing the convenience of preparing the favorite breakfast dainty.

The vertical type of toaster not only represented a marked advance in the direction of increased utility, but served to establish the superior value of Calorite as a resistance material for producing intense radiant heat under the



Improved Vertical Radiant Toaster.

influence of an electric current. As in the case of tungsten, tantalum and other metals used as efficient light givers, the history of Calorite, the new metal used as an efficient heat giver, is too familiar to bear repetition. It is significant, however, that its production practically renders unnecessary any further development for the present of the electrical component of electric heating and cooking devices. On the other hand, modifications in the mechanical design and construction of any class of devices, for the purpose of increasing their utility, beauty or convenience, are always more or less possible, and electrical cooking devices are no exception to the rule.

The 1911 model of the G-E vertical radiant toaster embodies new features, commendable to prospective users of such devices. The inclined rack has been substituted for the perpendicular holder of the earlier design for increasing the convenience of the toaster. The slices of toast are thus rendered more accessible, and can be turned around more readily during the process of toasting.

The individual contact plugs adopted for the ornamental electric heating and cooking devices are applied to the new toaster. The plugs are incased in polished nickel cylinders, which add to the attractiveness of the toaster and places it in harmony with its companions on the buffet.

KELLOGG SAO PAULO INSTALLATION.

Among the many common battery exchange systems installed recently by the Kellogg Switchboard & Supply Company, the 11 section 10,000 line capacity exchange for Sao Paulo, Brazil, is of special interest on account of its size and importance. This contract was handled by Mr. J. C. Mur-

Sao Paulo Telephone Switchboard.

ray, sales engineer. This system is to be used first as a magneto multiple lamp signal switchboard, but is so designed that it may be changed to a common battery system without discarding any of the original apparatus. The present equipment is 4960 lines.

This handsome, massive quartered oak board, illustrated herewith from photograph taken just previous to packing,

will be equipped for 31 operators' positions, each to have 15 universal cords with ring back keys.

The Kellogg Company have furnished complete accessory apparatus, including intermediate distributing frame, terminal clips, for 4960 lines on answering and multiple side. The relay frame is for 5400 subscribers' lines.

The Kellogg main distributing frame, is equipped with 4960 Kellogg arresters and terminal clips for 6250 outside lines. There is to be one-two position chief operator's desk and one-one position wire chief's desk.

The complete operating plant will be made up as follows: One set of 11 storage battery, 2 motor generator changing sets operated from 220 volts, 60 cycles, 3-phase alternating current, two ringing machines with howler attachment, one to operate from the battery and the other to operate from the primary battery circuit, one white Italian marble power switchboard.

The slight change in the wiring at the relay rack is all that is necessary to convert a magneto line to a common battery line. The cord circuits as furnished are of the universal type and will automatically adapt themselves to line conditions.

A NEW PORTABLE ELECTRIC BREAST DRILL.

A new line of "Western Electric" Hawthorn portable electric drills has just been placed on the market. These drills combine compactness and durability of construction with safe and reliable operation. They are made for use on 110 or 220 volt direct current, and 60 cycle, single phase, alternating current circuits, an Edison socket and cord being supplied so the drill can be operated from any standard lamp socket or screw base receptacle. The motor is incased in a dust-proof case and all electrical parts are well insulated and

Hawthorn Portable Electric Breast Drill

protected, insuring freedom from shocks. The frame is of black japan, with nickel-plated trimmings, and an aluminum breast-plate or spade handle can be had, as desired. Small oil chambers, so placed as to prevent leakage when the drill is being used, insure good lubrication for all moving parts.

The motor, weighing about twenty pounds, is supplied with two knurled side handles and the controlling switch is conveniently located within easy reach of the right hand grasping the handle, which allows the operator full control of drill. A Jacobs clutch, which takes drills up to and including ⅜ in. diameter, and the necessary tightening key are furnished.

NEW CATALOGUES.

Schureman Type Elevator Controllers, both direct and alternating current, are illustrated and described in a handsome booklet from the Cutler-Hammer Mfg. Co.

Bulletin No. 1117, describing central battery wall and desk sets, together with their accessories, for standard requirements, has just been issued by the Western Electric Company.

The Western Electric 1911 fan motor bulletin is now ready for distribution. This is listed in the series of publications of that company as bulletin No. 5352. It is contained within a stiff cover of bluish gray, with an attractive design.

TRADE NOTES.

The Westinghouse Electric & Manufacturing Company has just received an order for two 2000 k.v.a. water-wheel type generators and four 2000 k.v.a. oil-insulated water-cooled transformers for the main station of the Sao Paulo Tramway, Light & Power Company of Sao Paulo, Brazil.

The Pemberton Coal & Coke Company of Affinity, W. Va., has just placed an order with the Westinghouse Electric & Manufacturing Company for one 150 kw., 250-volt, 200 r.p.m., direct current engine type generator; one 150 k.v.a., 2500 volt, a.c. generator with exciter; a main station switchboard, and a 150 kw. substation motor generator set.

The Westinghouse Electric & Manufacturing Company has just placed upon the market a new trolley clamp that embodies several improvements. The swivel joint permits the boss to be screwed up tight to the stud; this keeps out moisture and prevents corrosion and wear of threads. The two side caps are absolute duplicates; the clamping pressure is therefore uniform. Having only two counter-sunk holes in each side, the clamp is stronger and the clamping pressure consequently more permanent. A few drops of solder in the swivel joint after the clamp is installed adapts it for feeding. The clamp can be installed with an ordinary screw-driver and a monkey-wrench, or with a special Type FB combined screw-driver and wrench especially designed for this service.

The Western Electric Company has just prepared for distribution an attractive 1911 wall calendar. The calendar, which has been finished in two colors, is of a pleasing design, and while the figures are large enough to be seen across the room, it is not too large for the office wall. The Western Electric Company's symbol, the familiar may of the United States within a circle, comprises the upper part of the calendar. The symbol represents the scope of activity of this company. A separate legend is provided for each of the twelve months, illustrating some phase of the company's manufacturing and selling program. Four cuts, showing the arc lamp, ventilating fan and power motor, and the Western Electric inter-phone, as typifying the "essentials of modern business"—light, ventilation, power and communication—also are prominently featured.

Recent sales made by the General Electric Company include to the Sierra & San Francisco Power Co., 1 motor generator set consisting of 1 CVC-4-14 kw.-1800-140 volt shunt wound generator direct connected to 1 I-4-20 h.p.-1800-440 volt form K 60 cycle induction motor; to the Yuba Construction Company, dredge equipment for Kirtley Creek, 1 I-12-200 h.p. 600-M-440 volt motor, 1 I-12-25 h.p.-600-M-440 volt motor, 1 I-10-75 h.p.-720-K-440 volt motor, 1 I-12-35 h.p.-600-K-440 volt motor, 1 I-6-15 h.p.-1200-K-440 volt motor, 1 I12-50 h.p.-600-M-440 volt motor, 1 I10-35 h.p.-720-M-440 volt motor, 1 I-4-2 h.p.-1800-K-440 volt motor, 3 H-60-125 k.v.a.-4000/2000 volt-460/230 volt secondary transformers, 1 H-60-7½ k.v.a.-4000/2000-115/230 volt transformers, switches and circuit breakers, cable and wire, switchboard; dredge equipment for Feather River: 1 I-14-300 h.p.-514-K-440 volt motor, 1 I-12-35 h.p.-600-M-440 volt motor, 1 I-12-150 h.p.-600-K-440 volt motor, 1 I-12-75 h.p.-600-K-440 volt motor, 1 I-6-25 h.p.-1200-K-440 volt motor, 1 I-12-75 h.p.-600-M-440 volt motor, 1 I-10-60 h.p.-720-M-440 volt motor, 1 I-4-2 h.p.-1800-K-440 volt motor, 3 H-60-200 k.v.a.-4000/2000-460/230 volt transformers, 1 H-60-10 k.v.a.-4000/2000-230/115 volt transformers, switches and circuit breakers, cable and wire, switchboard; to the Pacific Portland Cement Company: 1 I-LM-2 T-6-A-2 6-ton mining type locomotive; to the Oakland & Antioch Railway: 1 motor generator set consisting of 1 MPC-4-300 kw.-720-1200 volt shunt wound railway generator direct connected to and mounted on common base with 1 ATI-10-345 kw.-720-11000 volt synchronous motor, 1 6 kw. 125 volt d.c. direct connected exciter.

NEWS NOTES

INCORPORATIONS.

SAN FRANCISCO, CAL.—The Searchlight Gas Company has been incorporated by F. C. Egan, M. L. Cramer and S. H. Ellis, with a capital stock of $100,000.

SAN FRANCISCO, CAL.—The Monterey & Pacific Grove Telephone Company has been incorporated by E. C. Gee, C. Bull, J. D. O'Connell, R. C. Smith and H. Haber, with a capital stock of $100,000.

FINANCIAL.

SNOHOMISH, WASH.—The water bond election held for the purpose of validating $110,000 worth of bonds to be sold for the purpose of a gravity water system from the Pilchuck river at a point in the forest reserve 16 miles from Snohomish and above all settlements, resulted in favor of the bonds.

LOS ANGELES, CAL.—The New York syndicate holding an option of $4,896,000 worth of Owens River water supply system bonds has paid for $816,000 worth of the bonds with accrued interest of $24,480. This transaction, together with the announced intention of the syndicate to take over the entire amount of bonds covered by its option, insures the completion of the Owens River aqueduct early in the summer of next year.

SANTA ANA, CAL.—The City Council passed an ordinance calling a special election to be held on February 14th for voters to submit a vote on the proposition of incurring an indebtedness by issuing and selling bonds in the sum of $20,000 for the construction of a municipal water system for this city. The bonds are to be issued 20 in number and of $1000 each, to bear 4½ per cent interest per annum, interest payable semi-annually, on September 1st and March 1st of each year after their issue until paid.

SAN FRANCISCO, CAL.—The first bonds of the $45,000,000 issue recently voted for the Hetch Hetchy water system were offered to the public last week, but found no takers. Some of the local bond houses had made no secret of their opposition to the issue. They had even frankly expressed their intention of discouraging the sale. It was stated that, as a matter of policy, they would remain aloof until the city "took care of Spring Valley." The offering was in the sum of $1,125,000. The money is needed to complete the purchase of the Ham Hall properties and to begin preliminary work at Lake Eleanor. The present is not regarded as an opportune moment for the sale of municipals in the United States. A recent New York issue found its buyers in Germany. M. Brock, of N. W. Halsey & Co., one of the concerns which has heretofore bid readily and heavily for San Francisco securities, stated that the reason why his company did not bid for the offering of water-supply bonds was that they were offered for future delivery, the greater part on June 1, and the smaller part on March 1, whereas when his company bought bonds it desired to secure them immediately upon the acceptance of its bid. He declined to say whether or not there were other objections to the purchase, that which he had named, he said, being deemed sufficient.

ILLUMINATION.

MANILA, P. I.—The franchise to build and operate a gas plant in the city of Manila passed the assembly recently afternoon. Thos. D. Aitken, representing a German syndicate, is the concessionaire.

CALEXICO, CAL.—The Farmers' & Merchants' Club has appointed a committee, consisting of J. B. Hoffman, J. F. Steintorf and H. J. Rick, to get exact figures on cost of establishing and operating an electric lighting plant in connection with the water plant.

CHICO, CAL.—Contracts have been let by the Pacific Gas & Electric Company for the erection of a gas storage tank of 100,000 cubic feet capacity in order that the capacity of the local plant may be increased. It is thought the work will be commenced within the next 60 days.

MARYSVILLE, CAL.—A deal has been consummated in this city whereby Henry Berg, Jr., and Nate Metz of this city become the owners of the Live Oak & Encinal Light & Power Company. The purchase price is said to have been $10,000. The new firm, will, it is said, extend the power lines over Sutter county.

OGDEN, UTAH.—The City Council has passed an ordinance granting to A. L. Brewer, J. S. Lewis, M. S. Proing, Joseph S. Cowcroft, J. N. Spargo, and A. T. Wright, a franchise to construct, maintain and operate an electric heating, lighting and power system within the limits of Ogden.

LOS ANGELES, CAL.—The Southern California Gas Company has made application to the Supervisors for a 50-year franchise covering all roads and highways of Los Angeles county, except those on which the Domestic Gas Company obtained a franchise for its Glendale system. The Supervisors ordered that the franchise be advertised.

PORTERVILLE, CAL.—All of the stock of the Home Gas Company is now owned in Porterville, the Los Angeles promoters having been bought by local capitalists. At the stockholders' meeting a new board of directors, including Porterville people only, was elected as follows: W. B. Phillips, president; F. H. Hess, secretary and manager, and L. J. Cranston, treasurer; other members of the board, Daniel Abbott and E. E. Graham. Plans have been made for the reconstruction of the plant. A high pressure line is to be put in to cover the entire city and the capacity doubled.

POCATELLO, IDAHO.—Through the voluntary sacrifice of property valued at $100,000, former Governor Brady furnished electric lights to Pocatello, which had been in darkness since the substation and transformer house of Brady's power company was destroyed by flood water Wednesday night. By dynamiting the power company's dam, Brady, who personally superintendened the work of redeeming Pocatello from darkness, was able to reach the company's transformers, buried deep below the surface of a flood in the Portneuf River and connect them again with the company's high tension transmission line from the plant at Ann Falls. Three hundred pounds of dynamite were used in blowing out the company's dam to reduce the level of the flood water around the wrecked transformer house. By the lifting of the railroad blockade and the resumption of the electric light system Pocatello is once again in normal condition.

PALO ALTO, CAL.—The Palo Alto Gas Company has offered to sell to the city of Palo Alto its plant, and a conference has been arranged between the representatives of the company and the officials of the city to arrange terms. The gas company has made the claim for some time that it was not making any money in Palo Alto and inasmuch as the city demands 2 per cent of the company's gross earnings and compelled it also to reduce its minimum charge to 50c per month after the company had raised the charge from 50c to $1, the gas officials think they are not being justly treated.

By the franchise the company is given the option on the purchase of the plant at the end of ten years. Three years remain until the franchise would call for such a conference as the gas company has now asked for. City Engineer Byxbee is compiling figures under the direction of the City Council, with a view of reducing the cost to the consumer of water and light, the plants for which are owned by the city.

TRANSMISSION.

SPOKANE, WASH.—The Washington Water Power Company has started preliminary work for installation of a power plant at Little Falls.

LEWISTON, IDAHO.—Engineers will soon make a preliminary inspection of the dam site at Kooskia preparatory to starting construction work for the Kooskia Land & Power Company.

SPOKANE, WASH.—The Pacific Power & Light Company is building a heavy copper wire power line from Priest Rapids to Beverly, Wahluke,, White Bluffs and Hanford, a distance of 35 miles.

GILMORE, IDAHO.—Plans are being prepared for the installation of a 600 h.p. power plant for furnishing power to the Gilmore mines, and also for furnishing this place with light and power.

VALE, ORE.—The Telluride Power Company will within the next two months connect this place with its big Malad River, Idaho, electric plant. The company is to build 150 miles of transmission line.

EUGENE, ORE.—The city has directed the city attorney to prepare an amendment providing for the issuance of $25,000 in bonds for the construction of a tungsten incandescent street lighting system.

SAN PEDRO, CAL.—During a thunder storm lightning struck the substation of the Southern California Edison Company on Terminal island, last week, and destroyed electrical transformers valued at $6000.

MEDFORD, ORE.—Harry C. Stoddard, superintendent of the Rogue River Electric Company, announces that work will start early this summer on the erection of a new power plant at Rogue River Falls, near Prospect.

PIERCE CITY, IDAHO.—The Pierce Power Company has completed plans for the installation of an electric power plant on its mining property one mile from this place. The plant will develop approximately 400 h.p., which will be used for operating dredges.

PIERCE CITY, IDAHO—The Sprague Company announces that the company will build a hydroelectric power plant about two miles above this place, with which to operate the mines of the Sprague Company, also the Idaho Placer Company and the Ozark quartz mine.

TURNER, ORE.—The Interior Warehouse Company, a branch of the Balfour, Guthrie Company, has secured a franchise from the council to install a plant for furnishing electric light to the town. Mayor Martin and the council are considering erecting lamp posts along the principal streets.

VANCOUVER, B. C.—The city electrician will soon ask the city for an appropriation of between $150,000 and $200,000 to be expended on new equipment and addition to the present system during the year. Among the supplies to be asked for are: 300 additional arc lamps, 40 fire alarm boxes, 15 semaphore street signals, 28 miles of wiring, 30 police call boxes and a large number of lamps.

WASHINGTON, D. C.—Applications to the Forest Service for permits to use water-power sites within national forests now number 28. Since the promulgation of the new regulations 12 projects have been acted on. The permits pending are located in Washington, Oregon, Montana, Idaho, Colorado, Utah and Minnesota. It is expected these will be passed on within a short time. They are now in the hands of the district foresters, and if favorably reported will be turned over to the companies which will build the projects.

SACRAMENTO, CAL.—A bill has been introduced by Assemblyman Kennedy of San Francisco to regulate telephone, telegraph and electric transmission wires. The bill requires that wires must be placed on the pole so as to be thirteen inches from the pole on either side, thereby allowing twenty-six inches of space in which the electricians may work. Representatives of the power, light, telegraph and telephone companies have appeared before the committee and made vigorout opposition to the bill, saying that it would work a great hardship upon them and compel them practically to reconstruct all their lines throughout the State.

TRANSPORTATION.

VALLEJO, CAL.—The long projected Vallejo & Northern Electric Railroad from Sacramento to this city is an assured fact, and that line will be in actual operation soon.

MODESTO, CAL.—The South San Joaquin Improvement Company has been granted a franchise to operate a single and double track electric street car line in certain streets of this city.

PETALUMA, CAL.—Ranchers in the vicinity of Two Rock Valley have presented a petition to the Petaluma & Santa Rosa Railway Company, asking that company to extend their line from Live Oak through Two Rock Valley.

LOS ANGELES, CAL.—Paul Shoup, manager of the electric systems for the Los Angeles Electric Railway corporation, is preparing to build a tunnel through the hills from Hill street westerly. Plans have practically been accepted and rights of way secured.

GLENDALE, CAL.—An electric line will be built from the Brand Boulevard, at about Arden street, Glendale, to Burbank. Property owners of Burbank and Glendale will raise $40,000 and a double track line will be laid. A franchise has been asked for.

VALLEJO, CAL.—The Board of Trustees passed an ordinance permitting the San Francisco, Vallejo & Napa Railroad Company to change and substitute a single pole T-arm construction in place of the present span construction along Sonoma street from Illinois street to the city limits.

ABERDEEN, WASH.—The Grays Harbor Railway & Light Company and Anderson & Middleton have consolidated and will operate under franchises granted the latter. Announcement is made that the present power plant will be enlarged and interurban road construction on the harbor started.

PRESCOTT, ARIZ.—The management of the Prescott Gas & Electric Company has stated that in February the new electric line to Miller Valley will be started and in a few weeks all places would be connected. The new line will be run from a distributing station in the northwestern part of the city, taking in Home Acre tract, and will terminate at Mountain View cemetery.

MIDDLETON, CAL.—The high waters of Putah Creek hold freight and mail marooned in Middletown for the town of Lower Lake. The storms have stayed progress on the Santa Rosa & Clear Lake scenic railroad over St. Helena Mountain, but the work of surveying the north side of the mountain will be taken up as soon as there is a break in the storm, and it is expected to have the cars running into Middleton by the middle of the coming summer.

SANTA ROSA, CAL.—The Petaluma & Santa Rosa Railway Corporation has filed suit against Geo. C. Miller, Daniel Brown Estate Co., et al., to condemn a right of way for the extension of its line into the heart of Petaluma, and give the railroad an uptown depot site. This is the first step toward carrying out the proposed improvement of the company's property. The company will change its line in Petaluma city so as to give it an uptown depot for passenger service. The property is in the vicinity of Main and Washington streets. It is expected that now the first step has been taken it will not be long before a move is made toward extending the line to deep water on San Francisco Bay at Point Pedro, and straightening the road between Petaluma and Santa Rosa by running a line from the Washie House through the Cotati and up the Petaluma boulevard.

WATERWORKS.

MEDFORD, ORE.—The City Council has passed ordinances providing for the laying of new water mains and sewers throughout the city.

VALLEJO, CAL.—The water-pipe contract was awarded last week to the United States Pipe Company, which bid $24,587.02. For the 8-inch and 14-inch pipe this company bid $30.25 a ton.

SACRAMENTO, CAL.—The joint resolution protesting against the Federal Government giving the Truckee General Electric Company a contract to divert the waters of Lake Tahoe into Nevada, has been passed by the Assembly and the Senate, the Senate inserting a declaration of State rights.

SAN FRANCISCO, CAL.—In the Market Street Securities Company's suit to recover 5000 shares of stock of the Sierra Nevada Water & Power Company turned over to the National Surety Company of New York as security for a bond, Superior Judge Hunt has granted an injunction restraining the surety company from disposing of the stock pending the trial of the case.

LOS ANGELES, CAL.—President Ed. T. Youmans and Secretary F. D. Cornell of the El Sobrante Land Company, which has just purchased 43,000 acres of land near Riverside, are planning to develop water extensively on the tract. It is planned to construct a dam across the canyon which will create a reservoir covering 250 acres and which will be of an average depth of 15 feet.

ASTORIA, ORE.—The Water Commission has awarded a contract to Palmberg & Matson for rebuilding 7½ miles of the wooden portion of the 18-inch main conduit leading from Bear Creek to the large reservoir, the contract price being $68,117.35. The pipe is to be built of redwood staves, and by the terms of the contract the work must be completed on or before September 1.

TACOMA, WASH.—Application has been made to the Board of County Commissioners for Pierce county, by the city of Tacoma, a municipal corporation, through its commissioner of water and light, for a franchise to construct and maintain within the easterly ten feet of the Mount Tacoma-Canyon road a flume of pipe for the purpose of conducting the water of the proposed Green River gravity water system of that city

DOUGLAS, ARIZ.—The City Council has awarded the contract for constructing a water system as follows: M. F. Dicus, local contractor, received the following contracts for concrete sump, oil reservoir, well tunnels, furnishing and laying of pipe connection, valves and general work for $40,000. Chicago Bridge & Iron Works received the contract for the water tower for $11,950; Denver Rock Drill & Mfg. Co., pumping equipment, $8510; Simplex Venturi meter at $572; Davergn Machinery Co., machinery at $19,945.

TACOMA, WASH.—The council has passed an ordinance providing for the construction of 12-inch, 14-inch, 16-inch and 18-inch wooden water mains in local improvement district No. 562 in this city.

OAKLAND, CAL.—Officials of the Peoples Water Company are considering the proposition of raising the dam at Lake Chabot in order that many millions of gallons of water which are now going to waste, may be saved. The recent rains have filled the lake and the excess waters are now running through the waste gates. It is estimated that the amount of water which is now running away is equivalent to a two years' supply. The lake now contains 5,500,000,000 gallons of water. By raising the dam higher the capacity of the lake, which is the chief reservoir of the People's company, may be increased to 11,000,000,000 gallons. When the dam was originally built it was so constructed as to provide for an addition to its height should the necessity ever arise.

OAKLAND, CAL.—The Peoples Water Company has filed with the finance committee of the City Council its report for the year 1910, upon which the water rate for the coming fiscal year will be fixed. The report gives in detail the amount paid by each individual ratepayer, the revenue derived from every source, an itemized account of expenditures made for supplying water, and amount of money expended in purchase, construction and maintenance of the property necessary to carrying on of business, since going into operation. The folowing is a summary for the Oakland division: Receipts—Water rates, $999,946.61; tapping, $28,984.15; turn on, $957; land rents, $32,263.89; total, $1,057,154.65. Expenses—Supply, $18,699.48; distribution, $105,681.07; repairs, $19,011.41; general expenses, $149,588.48; renewals, $3844.48; administration, $8800; service construction, $11,619.22; total $317,143.67. To this last total add $84,855.39 for taxes, a grand total of $401,999.06. The balance, or net earnings is $655,155.59. Following is a list of investments of the larger amounts: Real estate, $10,920.39; Alvarado wells, $6422.95; street mains, $102,284.89; meters, $57,810.16; central reservoir, $198,667.87; general $9603.92; total, $414,925.73.

SAN FRANCISCO, CAL.—City Engineer Marsden Manson considers $37,310,000 a price which may reasonably be paid by the city for the Spring Valley properties and system as a whole, so stating in a formal report to the Board of Public Works, which that body passed on last week to the Supervisors for the benefit of the public utilities committee. With his estimates the city engineer couples the suggestion that no time be lost in resuming and carrying to an effective conclusion, if possible, the negotiations for the acquisition of the properties, and presents arguments that such action would be good business policy, both for the city and the company. He suggests that in purchasing these properties "the city can better afford to deal generously, or, from the standpoint of some, extravagantly with the company" to the end that city officials may "devote their time and energies to developing the city instead of annually discussing the problem of rates and prices for months, only to need in costly and prolonged litigation, for which the city ultimately pays the cost of both sides." The city engineer suggests two plans for meeting the expenditure necessary to carry out his scheme of acquisition, one being that a sufficient amount be taken from the proceeds of the $45,000,000 water-supply bond issue, already authorized. The other plan calls for the passage of a charter amendment which will make the present rule limiting bond issue, to 15 per cent of the total city assessment, apply only to non-productive utilities, in which case there will be no difficulty in authorizing special bond issues for productive utilities. Engineer Manson closes his report which was called for a month ago by the public utilities committee, by suggesting that representatives of all parties and organizations be called to consider his suggestions before any definite action should be taken.